LAWSON SOUTH
RESIDENTIAL DEVELOPMENT
BELCONNEN, ACT

EPBC 2010/5549

PRELIMINARY DOCUMENTATION

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Prepared on behalf of the
Land Development Agency

May 2011

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1. INTRODUCTION

The Lawson South residential development was referred to the former Department of the Environment, Water, Heritage and the Arts (DEWHA), now the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC), under the *Environment Protection and Biodiversity Conservation Act* (*EPBC Act*) on 24 June 2010 and was subsequently determined to require approval from the Minister under the *Act* because of the potential for the development to have a significant impact on listed threatened species and ecological communities (Section 18 and 18A) and on Commonwealth land (Sections 26 and 27A)

The information contained in this preliminary documentation (PD) has been requested by DSEWPC to assist the Minister to make an informed decision on whether or not to approve the proposed Lawson South residential development. The information includes that which was presented in the referral documentation and additional specific information required by DSEWPC (see Appendix A).

The following technical reports contain the main supporting background information to the Preliminary Documentation and are submitted as separate documents:

- Attachment A
  Eco Logical Australia 2008, *Environmental studies. Lawson land release.* Report prepared for ACT Planning and Land Authority, Canberra.

- Attachment B
  Hogg, D.McC. and McIntosh, J. 2010, *Lawson South. Review of ecological information*. Report by David Hogg Pty Ltd to Land Development Agency, Canberra.

- Attachment C
  Rowell, A. 2010, *Golden sun moth survey at Lawson ACT, December 2009.* Report for David Hogg Pty Limited, Canberra.

- Attachment D
  Biosis Research 2011a, *Lawson South threatened grassland reptile survey report*. Report prepared for ACT Land Development Agency, Canberra.

- Attachment E
  Hogg, D.McC. 2010c, *A strategic approach to the conservation and environmental assessment of golden sun moth sites in the Canberra area, Interim revised report.* Report to the Land Development Agency, Canberra.

2. SUMMARY OF PROPOSED ACTION

2.1 Location and Description of Proposed Action

The proposed action is to develop a new residential estate, Lawson South, in the north-eastern part of the town of Belconnen in the Australian Capital Territory (see Figure 2.1). The development is surrounded by the existing suburbs of Kaleen, Bruce, Belconnen and McKellar. Lake Ginninderra bounds the area to the west and Commonwealth land, managed by the Department of Defence, adjoins the area to the north (see Figure 2.2). This land is the site of the former Belconnen Naval Transmitting Station (BNTS) and forms the northern part of the suburb of Lawson.

Lawson South covers an area of 100 hectares with 42 hectares proposed for development. The proposed action would involve the following activities within the development boundary:

- construction of roads and site services including water supply, sewerage, stormwater, electricity, gas and telecommunications;
- the release of residential blocks;
- construction of pedestrian and cycleway facilities;
- construction of community facilities, including community gardens;
- landscaping and embellishment of open space areas;
- construction of wetlands;
- the rehabilitation of College Creek; and
- a small amount of retailing.

Figure 2.3 shows the preliminary master plan for the proposed development. Approximately 1400 residential dwellings would be developed with the density of housing ranging from low (10 to 15 dwellings/ha) to high (60 to 100 dwellings/ha). An existing ActewAGL electricity substation will be retained within the south-western part of the area, but the relocation of 132 kV electricity transmission lines is being investigated through a separate process.

2.2 Background Investigations and Planning

Detailed planning for the development of Lawson South began in 2007 with the ACT Government commissioning the Lawson South Planning Study to identify opportunities for future urban development in Lawson. The Lawson South Planning Study final report was completed in October 2009 and envisaged Lawson South to be a liveable, sustainable 'urban village', and a well connected, integrated and compact neighbourhood, where residential densities are higher than surrounding established suburbs on the basis of providing more sustainable development and greater residential choice.

The Lawson South Planning study was endorsed by ACT Planning and Land Authority (ACTPLA) after a period of public consultation and a Draft Variation to the Territory Plan was prepared to change the existing low density residential RZ1 Suburban zone in Lawson South to a range of urban zones, including low, medium

and high density residential zones. Territory Plan Variation No. 299 took effect on 5 November 2010. The development is consistent with other ACT planning documents including the National Capital Plan and the Canberra Spatial Plan.

The Lawson South development has also been planned to take account of potential development within the adjoining Commonwealth land for which planning is being undertaken concurrently, but independently, to this project. Development Control Plan 10/03 for the Commonwealth land was approved in May 2010 by the National Capital Authority. The DCP proposes that the majority of the land be conserved in a grassland nature reserve and a small proportion, those areas of least ecological value, be developed for residential purposes.

The ACT land release program indicates that the first 650 blocks in Lawson South are to be released in 2011/12, with a further 500 blocks released in 2012/13 and 240 blocks in 2013/14.

3. DESCRIPTION OF THE ENVIRONMENT

3.1 Overview of the Existing Environment

3.1.1 Physical characteristics

The majority of the proposed Lawson South development area is located on gently undulating land with slopes ranging between 2 and 4 percent. A ridgeline traverses the eastern part of the area in a north-south direction and Reservoir Hill, with moderate to steep slopes ranging between 8 and 20 percent, is located in the south-eastern corner of the area. A major survey control mark known as 'Reservoir Trig' is located on Reservoir Hill.

College Creek begins as an open defined watercourse in the eastern part of the area and is located adjacent to Ginninderra Drive before running through the proposed development site in a north-west direction. The creek is generally slow flowing and receives inflow from Kaleen, the University of Canberra and other parts of Bruce. It also receives water from the south-eastern corner of the proposed development area.

The land between the eastern ridgeline and the lake is gently undulating and contains drainage gullies that meander westward to the lake. East of the ridgeline, a small ephemeral drainage channel drains parallel with Baldwin Drive and south to Ginninderra Drive.

The ActewAGL electricity substation is located in the south-western part of the area. This substation would remain and would be incorporated into the Lawson South development. 132 kV overhead transmission lines traverse the southern part of Lawson South. Investigations to relocate these services, possibly underground, are currently in progress. There are also 11 kV overhead lines originating from the substation.

3.1.2 Vegetation

Much of the vegetation within the Lawson South area has been modified by a long history of agricultural use. A 2008 assessment (Eco Logical 2008) of the Lawson South area found it to contain a diverse range of vegetation communities in various ecological conditions. These include small patches of natural temperate grassland through to large areas of exotic pasture, modified remnants of yellow box – red gum grassy woodland and peppermint – apple box woodland communities, secondary grassland associated with the red stringybark – scribbly gum forest, riparian vegetation and forward plantings of native and exotic tree and shrub species.

A 2010 review of the vegetation within the area confirmed that most of the ecological characteristics of the area remained unchanged but noted an increase in the cover of native grasses throughout the site as well as some new or maturing woodland regeneration on the lower north-western slopes of Reservoir Hill (Hogg and McIntosh 2010). The regeneration of native grasses is most noticeable in the western part of the site and on the upper slopes of Reservoir Hill. These areas, however, remain in a degraded condition.

Two small isolated patches of grassland, covering a maximum area of 1.35 hectares, occur in the central northern and south-eastern part of the Lawson South area and belong to the Commonwealth listed endangered ecological community, Natural Temperate Grasslands of the Southern Tablelands of NSW and the ACT. Previous land management has modified these areas which now contain mostly native grasses with some disturbance tolerant native forbs.

With the exception of these patches, most of the area contains a low component of native forbs. Weeds that are common throughout the area include serrated tussock (*Nassella trichotoma*), St John's wort (*Hypericum perforatum*), saffron thistle (*Carthamus lanatus*) and catsear (*Hypochaeris radicata*). In the eastern part of the area, woody weeds such as Nepal firethorn (*Pyracantha crenulata)* are common.

3.1.3 Fauna and fauna habitat

The faunal diversity of the area is low, with common birds, rabbits, brown hares and foxes being the only vertebrate animals observed during site inspections (Ecological 2008, Hogg and McIntosh 2010).

The main habitat feature of the site is the presence of natural temperate grassland, native pasture and secondary grassland which supports a population of the golden sun moth (*Synemon plana*) listed as critically endangered under the *EPBC Act*. This grassland environment can also provide habitat for the striped legless lizard (*Delma impar*), listed as vulnerable under the *EPBC Act,* however it has not been recorded in surveys undertaken within the Lawson South development area in the three surveys undertaken to date. The golden sun moth habitat and potential habitat of the striped legless lizard at South Lawson is continuous with habitat on thee adjoining Belconnen Naval Transmission Station. These species are discussed further in Chapters 4 and 5 respectively.

College Creek has limited ecological value in its current degraded condition but may provide habitat to a variety of species including birds, reptiles, amphibians and aquatic invertebrates. The common eastern froglet (*Crinia signifera)*, a common ACT frog species, was heard in the creek during a site inspection in August 2009 (McIntosh and Hogg, 2009).

Apart from some scattered remnant trees, which may provide habitat for some common woodland birds, there are no other features of habitat importance within the Lawson South area.

3.1.4 Indigenous heritage features

Previous surveys indicated the presence of six Aboriginal sites and one potential archaeological deposit (PAD) throughout the Lawson South residential development site. The most recent archaeological assessment was undertaken in 2009 by Navin Officer Heritage Consultants Pty Ltd (2009) for the purpose of identifying actual and potential archaeological sites and for the preparation of a conservation management plan if required. The assessment included consultation and liaison with the ACT Heritage Council, ACTPLA and ACT Representative Aboriginal Organisations (RAOs). No Aboriginal artefacts were found throughout the site and the PAD is

considered to have low archaeological potential. There are no unresolved constraints relating to indigenous heritage values at the site and the ACT Heritage Council has agreed to the proposed development.

3.1.5 Other environmental factors

A historic windbreak of *Pinus radiata* is located on the ridgeline to the north of the peak of Reservoir Hill. The windbreak was planted in 1939 when the BNTS site was established. A pre-c.1915 travelling stock route is located in the western part of Lawson South and runs through the area in a north-south direction. Both of these features would be retained and incorporated into the open space network of Lawson South. These features have no regulatory heritage value.

Commonwealth land containing a large area of high quality natural temperate grassland is located adjacent to the area to the north as well as a remnant patch of woodland that belongs to the White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grasslands endangered ecological community. This is discussed in Chapter 7.

3.1.6 Land use and tenure

The area is within Territory land which has been recently withdrawn from a short-term rural lease pending development. It is now subject to periodic grazing through an informal agreement. The other existing land use is the ActewAGL substation located in the south-western part of Lawson South.

3.2 Matters of National Environmental Significance

The development would result in the removal of vegetation that is providing habitat to the critically endangered golden sun moth and has been assessed as potential habitat for the striped legless lizard. This vegetation includes most of the natural temperate grassland endangered ecological community within the Lawson South area. It is the impacts on these threatened species and ecological communities, and the potential impacts on the adjacent Commonwealth land, that resulted in the preparation of a referral and the subsequent determination of the proposed development to be a controlled action under the *EPBC Act.*

Chapters 4, 5, 6 and 7 of the Preliminary Documentation provide more detailed assessments of the impacts on each of these entities. Those assessments include specific references to the additional information requested by DSEWPC (formerly DEWHA) in its determination on the referral.

The assessment also takes account of the following statements in *EPBC Act* Policy Statements 1.1 (Matters of National Environmental Significance), 1.2 (Commonwealth land) and 3.12 (Golden sun moth) :

- *A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the*

intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on matters of national environmental significance.

- *Significant impact judgements must be made on a case by case basis and with consideration for the context of the action.*

The detailed assessments in Chapters 4, 5, 6 and 7 emphasise the context relevant to those matters of national environmental significance in the ACT, drawing on strategic documents for biodiversity planning prepared by or on behalf of the ACT Government.

The proposed development would not have any impacts on the following matters of National Environmental Significance as listed under the *EPBC Act*:

- World Heritage properties;
- National Heritage places;
- wetlands of international importance (declared Ramsar wetlands)
- listed migratory species;
- Commonwealth marine area; and
- the Great Barrier Reef Marine Park.

3.3 General Impacts of Development

The development of Lawson South is likely to impact extensively on the majority of the area as indicated in Figure 3.1. These impacts would result from residential development, roads and other infrastructure, landscaping of urban open space and construction of wetlands. In all of these areas impacted, the surface vegetation and habitat is likely to be substantially disturbed, even though the open space and wetland areas may not contain much building or infrastructure development.

In the remaining areas, which include the upper slopes of Reservoir Hill and much of the 30 metre wide buffer strip along the northern boundary, there would be localised disturbance, for example, the construction of paths, fire access tracks, playgrounds and picnic facilities, but the majority of these areas are likely to retain the existing groundcover. It is not intended that these areas would be managed as nature reserves, although they may continue to have some habitat value.

4. GOLDEN SUN MOTH

4.1 Existing Conditions and Impacts

Surveys for the golden sun moth in 2007 and 2009 found the species to be present in low to moderate numbers across the Lawson South area with the distribution of the male flying moths generally associated with native pasture and natural temperate grassland.

The 2007 survey was carried out late in the flying season and included three site visits between 15 and 21 December. The conditions were ideal for detecting the presence of the species with the weather being warm, dry, sunny and relatively calm (Eco Logical 2008). The survey methodology combined the use of transect surveys with meandering transects, the former being carried out in those areas considered to be potential habitat for the moth and the latter in areas considered less likely to be golden sun moth habitat. For the purpose of this survey, potential habitat was defined as grassland dominated by native grasses, especially wallaby grasses and spear grasses. The location of the transect surveys and the area surveyed by meandering traverses in 2007 is shown in Figure 4.1.

The 2009 survey was carried out in suitable conditions on 16 December (Rowell 2010). Meandering transects were traversed by foot and vehicle across much of the Lawson South area with observers stopping and carrying out two minute counts each time a moth was sighted. The general survey route is shown in Figure 4.1. This route covered all of the potential habitat within Lawson South.

Figure 4.2 shows the results of the golden sun moth surveys for 2007 (Eco Logical 2008) and 2009 (Rowell 2010) and maps the extent of the known and potential habitat within Lawson South based on these survey results and existing vegetation mapping (Eco Logical 2008, Hogg & McIntosh 2010).

Known habitat for the species has been mapped as those areas in which the male golden sun moth has been recorded flying throughout the site. Known habitat occurs across a range of vegetation types including natural temperate grassland, native pasture, secondary grassland and an open area within peppermint – apple box woodland. In the western part of the site it extends into an area dominated by exotic pasture that is regenerating with native grasses and it also includes the western edge of the remnant woodland patch in the central part of Lawson South. The majority of the moths were recorded flying between the elevations of 590 and 615 metres. On the eastern side of Reservoir Hill, a small number of moths were recorded flying up to elevations of 625 metres during both 2007 and 2009 surveys and in 2009, a single golden sun moth was recorded in exotic pasture close to the peak of Reservoir Hill above 630 metres.

One female moth was recorded in the central part of the area during each of the 2007 and 2009 surveys, indicating that at least part of the area contains breeding habitat for the species.

The extent of known habitat as mapped in Figure 4.2 covers approximately 35 hectares and represents the total distribution of the species throughout the site rather than actual breeding habitat. Male moths can disperse approximately 100

metres from their breeding areas (DEWHA 2009) so while areas within which golden sun moths have been sighted can be mapped with a moderate degree of accuracy, this does not necessarily mean that the whole of such areas is used as breeding habitat. Determining breeding habitat requires targeted searches for either the non-flying female moths or pupal cases, however, due to the low to moderate numbers of the moth spread across a large area within Lawson South, undertaking field surveys to determine individual areas of breeding habitat and subsequently mapping these areas is not feasible.

The mapping of potential golden sun moth habitat is even more problematic. The golden sun moth is primarily a natural temperate grassland species, with an apparent preference for *Austrodanthonia* grass species but, as is evident in Lawson South, it extends also into secondary grassland within the woodland community. It can also utilise a range of native grasses as well as the introduced Chilean needle grass. Throughout the ACT, the species has been observed in sites that would previously have not been considered to be appropriate habitat, such as road medians which have undergone total disturbance in the past (Hogg 2010b,c). In the regional context, potential habitat for the golden sun moth would therefore include all land within Canberra's nature reserves, urban areas and surrounding rural areas which has a high component of common native grasses and/ or Chilean needle grass.

Within Lawson South, potential habitat is assessed as being those areas of native pasture and secondary grassland vegetation in which the golden sun moth was not detected during the 2007 or 2009 surveys. This vegetation is where the majority of the golden sun moth records occur throughout the rest of the site and the presence of golden sun moth in these areas can therefore not be discounted. Approximately 20 hectares of native pasture and secondary grassland is considered to be potential golden sun moth habitat throughout Lawson South.

While a total of two flying moths was recorded in exotic pasture in the south-western part of the site and near the peak of Reservoir Hill during the 2009 surveys and these areas have been mapped as known habitat, other areas of exotic pasture have not been mapped as potential golden sun moth habitat as the species is not generally associated with this lower quality vegetation. The presence of the moths in this exotic vegetation is most likely a result of exceptional dispersal and it is highly unlikely to be breeding in these areas. There are no records of Chilean needle grass throughout Lawson South.

It is important to note that the boundaries of known and potential habitat for the golden sun moth within Lawson South in Figure 4.2 are notional only and have been determined using a combination of survey results, existing vegetation mapping and using information, known and emerging, about the golden sun moth ecology and its preferred habitat. The map should be interpreted with the knowledge that the boundaries are indicative only and there is possibility for a substantial margin of error.

The proposed development of Lawson South, including roads, wetlands and landscaping works, would result in the removal of about 32 hectares of moderate quality habitat supporting a low density population of golden sun moths, plus a

further 16 hectares of potential habitat (see Figure 4.3). The area removed would be between 85 and 90 percent of the existing habitat. Some of the known or potential habitat is proposed to be retained in open space within the development and in a 30 metre wide buffer area along the northern boundary of the suburb. Based on observations elsewhere in Canberra, these open space areas could maintain golden sun moth populations, if they are managed appropriately.

4.2 Regional Context

Conservation of the golden sun moth within the ACT was addressed first through Action Plan No. 7 (ACT Government 1998) prepared under the ACT *Nature Conservation Act* (*NC Act*), then in a more integrated context through Action Plan No. 28, the ACT Lowland Native Grassland Conservation Strategy (ACT Government 2005). Since those Action Plans were prepared, the number of sites where the golden sun moth has been recorded in the ACT has increased substantially to approximately 60 sites (Hogg 2010c). As many of these sites are within areas required for future urban development, the Land Development Agency, in consultation with other ACT Government agencies, has initiated the preparation of a strategic approach to the conservation and environmental assessment of golden sun moth sites in the Canberra area (Hogg 2009, 2010c). While it has not yet been formally adopted by the ACT Government, this draft strategy provides a broad context for addressing golden sun moth conservation in the ACT.

Of the 60 sites listed in the most recent report on that strategy (Hogg 2010c), 14 are in Belconnen, 19 are located in Gungahlin and 5 in the north of Central Canberra. The extent of golden sun moth habitat in Canberra is shown in Figure 4.4, although the habitat areas indicated are not necessarily a reflection of the level of golden sun moth activity.

Figure 4.5 presents an alternative representation of the known distribution of golden sun moths in the Canberra area, indicating the habitat type and relative population size or activity at each site. The size of the circles reflects in broad terms the typical level of observed golden sun moth activity as a surrogate for population size. Accurate estimates of population size, taken as meaning the number of adult moths emerging during a summer season, requires intensive, specialised survey and has been attempted at very few sites in the Canberra area.

The colours within the circles represent the habitat types, which are summarised as follows (Hogg 2010c):

Type A. Natural temperate grassland/ high quality native pasture – large area
Type B. Natural temperate grassland/ high quality native pasture – smaller remnant
Type C. Mixed native and exotic grasses in former natural temperate grassland
Type D. Secondary grassland (box – gum woodland community)
Type E. Chilean needle grass or other exotic grasses.

These habitat types are ranked from best to worst, reflecting their current and potential future value as golden sun moth habitat.

The highest quality habitat consists of large areas of natural temperate grassland. In North Canberra, this is found in the former Belconnen Naval Transmitting Station (BNTS) at Lawson (B1) which is adjacent to Lawson South, the three grassland nature reserves in Gungahlin (Sites G1, G2 and G3), another grassland reserve at North Mitchell (G4), and the Dunlop Nature Reserve (B4). Another major area of golden sun moth activity is at Macgregor West (B5) where very high numbers of moths have been recorded in association with Chilean needle grass, a weed of national significance.

Most of the literature about the golden sun moth describes it as a natural temperate grassland species. However, the recent (mostly 2009) findings of the species in many secondary grassland sites, albeit at low densities, suggests that it may have extended its range into these areas, possibly as a result of past land clearing which converted the woodland to native grassland. The Lawson South site and many sites within the Gungahlin region fall into this category. The process of pastoral settlement also resulted in ploughing of much of the better cropping terrain on natural temperate grassland, destroying the golden sun moth habitat in most of those areas, and leading to the moth becoming a threatened species. While the secondary grassland contains many sites supporting low numbers of golden sun moths, these are not its primary habitat and there is potential for the long term viability of these sites to be threatened by the natural regeneration of woodland, particularly in those areas of Gungahlin, that have not yet been withdrawn from rural lease.

The golden sun moth draft strategy therefore places the highest priority on maintaining and enhancing natural temperate grassland areas as habitat. This has been largely achieved through existing grassland nature reserves, particularly in Gungahlin, as well as by appropriate management of Commonwealth institutional land, such as the former BNTS adjacent to Lawson South, much of which is planned to be retained in a future conservation reserve. Many of the smaller golden sun moth sites, particularly those in Central Canberra, are also located in remnants of natural temperate grassland. These have maintained viable golden sun moth populations for many decades, despite the presence of surrounding roads, houses and other developments, and also have relatively high priority for conservation.

The sites in North Canberra (Belconnen, Gungahlin, Central Canberra North) where the golden sun moth has been recorded are listed in Table 4.1. Where areas are stated in relation to nature reserves etc., these may be the total area of the reserve, not all of which may be golden sun moth habitat. At many sites, the potential habitat areas are so broad and the moth population so small and dispersed that it is meaningless to attempt to quantify the habitat area. In such cases, only a general description of the extent of the area is provided.

Table 4.1 Known golden sun moth sites in North Canberra

Site numbers (e.g. G1) refer to Figures 4.4 and 4.5.

Site	Area *	Population size/activity	Land use/security
Gungahlin			
G1. Mulanggari Nature Reserve	Large (68 ha)	Low	Nature reserve
G2. Crace Nature Reserve	Large (136 ha)	Moderate	Nature reserve
G3. Gungaderra Nature Reserve	Large (187 ha)	Low	Nature reserve
G4. North Mitchell grasslands	Medium (15 ha)	Low	Urban open space/grassland reserve
G5. Mulligans Flat North/Bonner 4	Medium/ large (20 ha)	Low	Part native reserve, part proposal urban
G6. Mulligans Flat South-east	Medium/ large (50 ha)	Very low	Nature reserve
G7. Mulligans Flat South-west	Medium (5 ha)	Very low	Nature reserve
G8. Moncrieff South	Large (28 ha)	Moderate	Proposed urban, some open space/conservation reserve
G9. Goorooyarroo Nature Reserve	Uncertain	Uncertain	Nature reserve
G10. Jacka North	Large	Low	Rural, proposed urban
G11. Jacka South/ Moncrieff North	Large	Very low	Rural, proposed urban
G12. Throsby residential	Large	Low	Rural proposed urban
G13. Throsby playing fields	Medium	Low	Rural, proposed urban open space
G14. Well Station Drive (hill)	Small	Low	Proposed urban, possible open space
G15. Harrison 4	Uncertain	Very low	Proposed urban
G16. Forde North	Small	Low	Proposed urban
G17. Ngunnawal 2C	Medium (8 ha)	Low	Proposed urban
G18. Gold Creek (Hall)	Uncertain	Moderate	Uncertain
G19. Block 799, Gungahlin	Small (2.4 ha)	Low	Proposed tourist development
Belconnen			
B1. Former Belconnen Naval Transmitting Station	Large (120 ha)	High	Commonwealth land, potential nature reserve
B2. Lawson South	Large (55 ha)	Moderate	Proposed urban, some open space
B3. Lake Ginninderra	Small (0.2 ha)	Low	Urban open space
B4. Dunlop Nature Reserve North	Large (82 ha)	Low – moderate	Nature reserve
B5. Macgregor West – north-east	Large (70 ha)	Very high	Proposed open space/grassland reserve
B6. Macgregor West– west	Medium	Low	Proposed urban
B7. Lower Ginninderra Creek	Medium	Low	Rural
B8. Jarramlee Road – west	Medium/ large	Low	Rural
B9. Wallaroo Road	Medium	Low	Rural
B10. Ginninderra Creek, Macgregor	Small scattered patches	Very low	Urban open space
B11. Dunlop powerlines	Medium	Very low	Powerline easement
B12. Umbagong Park, Latham	Large	Very low	Urban open space
B13. Balamara Street, Giralang	Small	Low	Road verge
B14. University of Canberra	Medium	Low	University campus/road verge
Central Canberra (north)			
C7. St John's Church, Reid	Small (0.9 ha)	Low	Church grounds, road verge
C8. Campbell Section 5 (Constitution Avenue)	Medium (7 ha)	Low to moderate	Part likely to be developed, with some retained as open space
C9. CS RO Headquarters, Campbell	Medium (3 ha)	No longer present?	Future use uncertain
C10. Yarramundi Reach	Large (21 ha)	No longer present?	Open space
C12. Fisher Park, Ainslie	Small	Low	Urban open space
C15. City Hill South	Small	Moderate	Road verge

Adapted from Hogg 2010c.

* Where actual areas are stated, these generally relate to the size of the site and not necessarily the area of golden sun moth habitat. They should therefore be treated as indicative only. In many cases, the habitat is too ill-defined to attempt to make a meaningful estimate of its area.

A summary of the information in Table 4.1 is as follows:

- The most important golden sun moth site in North Canberra appears to be at the former BNTS in Lawson. This site is adjacent to the northern boundary of the Lawson South suburb and contains natural temperate grassland with a range of other important ecological values, including other threatened species, but is currently on Commonwealth land and is not under the control of the ACT Government.
- The other major site in Belconnen is at Macgregor West in habitat of relatively poor quality, including a large area of Chilean needle grass, where the highest moth densities have been recorded.
- The golden sun moth is present also at low densities in much of the rural land between North-west Belconnen and the ACT border as well as in the Dunlop Grasslands Nature Reserve (English, Dessman and O'Sullivan 2010, Hogg 2010a).
- The remaining golden sun moth sites within Belconnen, as well as those in Central Canberra, are small in both area and population size. These are mainly located within urban areas where they have either maintained viable populations of golden sun moths for many decades, despite the effects of surrounding development, or have been recolonised relatively recently. They demonstrate the ability of the golden sun moth to survive in modified situations without the need for buffer areas
- The most extensive areas of golden sun moth habitat in Gungahlin is within the three grassland nature reserves (Crace, Mulanggari and Gungaderra) and the North Mitchell grasslands. These are all areas of former natural temperate grassland, with that community remaining in much of the reserves, despite the presence of some areas of exotic pasture. While the golden sun moth is present in these nature reserves, it has generally been recorded in only low to moderate numbers.
- The remaining sites within Gungahlin have mostly low to very low numbers of golden sun moths, and are mainly in secondary grassland. Of these sites, the largest population appears to be at Moncrieff South.

4.3 Regional Significance of the Golden Sun Moth Population at Lawson South

The following factors are considered in assessing the regional significance of the golden sun moth population at Lawson South:

- The site is likely to have originally supported box – gum woodland or other woodland or forest communities, and would not have been suitable for the golden sun moth. Past land clearing has created a secondary grassland community which has enabled the golden sun moth to utilise the area.
- The golden sun moth populations are relatively small and widely dispersed at a very low density, and may be detectable only under the most favourable seasonal conditions.

- The habitat quality is generally limited, with many of the areas having regenerated recently to a native or semi-native condition from predominantly exotic pasture.
- If allowed to regenerate further, it is likely that woodland tree regeneration or dense grass growth will reduce the suitability of the habitat for golden sun moths, possibly causing them to disappear from the area.
- The most promising golden sun moth sites within secondary grassland in Canberra have been withdrawn from urban development (the north-eastern corner of Bonner, G5) or are currently subject to a separate review (the south of Moncrieff G8). Several other smaller sites also have potential to be retained within open space in the course of further planning.
- The most suitable golden sun moth habitat and the largest golden sun moth population in North-east Belconnen are located within the adjoining former Belconnen Naval Transmitting Station at Lawson North. The quality of the 120 hectares of habitat on the Transmission Station and the density and total number of moths recorded here is much higher than that of the 32 ha of habitat at South Lawson. Nevertheless South Lawson represents about 20% of the total habitat of the Lawson golden sun moth population. Given the large amount of habitat on the Transmission Station and the very large population supported, loss of habitat at South Lawson, is unlikely to impact on the viability of the overall Lawson population. The offset package described at section X.X is also likely to ensure that the population on North Lawson is enhanced through favourable management.

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Both in a wider regional context and in relation to North Canberra, the Lawson South site is considered to be of low priority for golden sun moth conservation. The loss of golden sun moth habitat from the site would not significantly affect the conservation status of the species in the ACT, and is not considered to be a significant impact of development.

4.4 Conservation Priorities and Habitat Fragmentation in North Canberra

The golden sun moth draft strategy (Hogg 2010c) proposes specific conservation targets for maintaining secure populations of the golden sun moth in the Canberra area in the long term. These are summarised as follows:

1. Two separate grassland conservation reserves containing viable golden sun moth populations in each of:
    - Majura;
    - Jerrabomberra;
    - Gungahlin; and
    - Belconnen.

    These should contain relatively large areas of golden sun moth habitat, managed under regimes which have potential to sustain golden sun moth populations in the long term, recognising that the optimum management requirements for golden sun moth may not be fully understood. These

reserves would be the core conservation areas for golden sun moth in an environment which is as close as practicable to the typical natural habitat for the species. In Belconnen, this could include the Dunlop Nature Reserve (B4) and the BNTS (B1) once the conservation status or an alternative secure management regime for the area has been formalised.

2. At least two additional golden sun moth habitat sites as current or former natural temperate grassland in each of the above four areas which could be used, if required, as a local (i.e. same valley system) source of specimens for translocation to the main reserves in the event of population loss (e.g. through an intense fire). The grassland north-east of the Macgregor West 2 Estate development (B5) and the areas of Lower Ginninderra Creek (B7), Jarramlee Road – west (B8), Wallaroo Road (B9) and the University of Canberra (B14) are potential sites in Belconnen. An area of natural temperate grassland proposed to be conserved within the buffer area on the northern edge of Lawson South, if appropriately managed to retain a golden sun moth population, could also fall into this category.

3. At least six apparently stable golden sun moth habitat sites within Central Canberra, recognising that the opportunity to conserve large grassland reserves in this area is no longer available (and has not existed for many years).

4. At least six viable sites within secondary grassland, recognising that golden sun moth populations in such sites may decline over time as a result of woodland tree regeneration. These sites are likely to be in Gungahlin, where most sites of this type have been recorded.

5. Any sites which have a long and reliable history of scientific monitoring, which would be difficult to replicate elsewhere, or are otherwise particularly significant from a scientific perspective, for example, because of their use for major grassland rehabilitation trials.

Some of the sites conserved under points 4 and 5 may be the same as those conserved under points 1, 2 or 3.

Conservation of the entire Lawson South area for golden sun moth habitat is not identified in the draft strategy as the area is predominantly a secondary grassland site and contains low to moderate number of moths across a large area of moderate quality habitat. The area is adjacent to the former BNTS site which contains high quality natural temperate grassland and is one of the ACT's core golden sun moth populations. This is the most appropriate area on which to focus local efforts directed at maintaining and enhancing a golden sun moth population.

The natural temperate grassland area to be retained within the buffer strip on the northern edge of Lawson South, however, has been identified as potentially satisfying the requirements of point 2, if it is managed for the conservation of the species. Appropriate management of this area would maintain habitat connectivity with the natural temperate grassland in the adjacent BNTS, increasing the effective size of this habitat and the viability of the population at this site.

4.5 Protection of Golden Sun Moth Habitat in Lawson South

Figure 4.3 illustrates the current Lawson South development footprint with potential and known golden sun moth habitat. Golden sun moth habitat would be removed on the lower slopes east and west of the ridgeline and would be retained as urban open space, on the east and south facing slopes of Reservoir Hill and along the northern boundary of the suburb.

The management of these urban open space areas would be the responsibility of the Parks and Conservation Section of Territory and Municipal Services. The specific management regime for the grassland areas would be addressed at a later date but would include issues such as weed management, burning and slashing.

Measures to mitigate impacts on the golden sun moth within Lawson South include the establishment of a 30 metre wide ecological buffer zone along the northern boundary of the site to preserve some potential and known golden sun moth habitat. This buffer incorporates a patch of natural temperate grassland, which is the highest quality habitat for the species that is present throughout the site.

Other mitigation measures include the appropriate placement and use of native species in the landscaping of the future suburb. This would include no tree planting in areas of close proximity to the natural temperate grassland, the use of native species in suitable public planting areas to enhance the habitat for golden sun moth and the re-establishment of native grass cover between the edge road and the boundary fence (i.e. within the buffer zone) using seed collected from the adjacent grassland in the Commonwealth land.

5. STRIPED LEGLESS LIZARD

5.1 Existing Conditions

The striped legless lizard has not been recorded in the Lawson South development area to date, despite three separate surveys for the species that were undertaken in 2001, 2008 and 2010.

The first survey was undertaken by HLA Envirosciences Pty Limited (HLA) for the Department of Defence Corporate Services and Infrastructure Group to determine whether the striped legless lizard was present within selected habitats in the suburb of Lawson. The surveys were undertaken as part of a review of the significance of the flora and fauna of the BNTS site and as input to the investigations concerning the possible future use of the Defence property at Lawson after decommissioning of the BNTS (HLA 2002).

HLA conducted surveys for the species on 28 consecutive nights between 22 November 2001 and 20 December 2001. The survey method utilised pitfall trapping at four different arrays, the locations of each array being chosen in consultation with the Department of Defence and the Wildlife Research and Monitoring department of Environment ACT (now known as Conservation Planning and Research). Two arrays, each consisting of 20 pitfall traps, were located on the Commonwealth land outside the secure fenced area and two were placed within the Lawson South area. The vegetation at each array was similar to those grassland areas that were known to support populations of the striped legless lizard elsewhere in the ACT. The lizard was captured on a total of five occasions (four individuals) in the two arrays that were located within the dry *Themeda* grassland in the Commonwealth land (see Figure 5.1). Surveys within the Lawson South area recorded no specimens.

In 2008, a survey for the species was undertaken by Eco Logical Australia Pty Limited (Eco Logical 2008) as part of the Lawson South Land Release Environmental Studies report. The tile survey method was used with eight tile arrays placed in potential habitat across the site on 25 January 2008. Ten complete checks of the tile arrays were conducted between 28 February 2008 and 10 March 2008. The surveys did not record any striped legless lizards at the site.

The most recent survey was carried out in December 2009 and January 2010 by Biosis Research Pty Ltd (Biosis 2011a). This survey primarily used pitfall trapping at ten locations, and also included four tile arrays as an additional and complementary survey technique. No striped legless lizards were recorded.

The striped legless lizard is diurnal and is surface active from late spring to early autumn with the highest activity period generally falling between September and December and thought to be associated with the mating and egg laying season for the species (Smith & Robertson 1999). The timing of the surveys by HLA and Biosis coincided with the later part of this period and, in the case of the Biosis survey, with a period when the striped legless lizard was being recorded in other locations in Canberra. The HLA survey was limited in its distribution within Lawson South with only two arrays located across the area, both being placed in potential habitat in the

western part of the site. The survey locations used by Biosis were representative of the whole of the potential habitat in Lawson South.

The surveys undertaken by Eco Logical were carried out in the latter part of the summer season at a time outside the recommended survey period. While the lizard is still surface active during February and March, it is less mobile and the chance of finding the species is greatly reduced. It is possible also that the lizard avoids the tiles during the hotter summer months as they become too hot to shelter under (O'Shea 2005). The result of this survey is therefore inconclusive in determining the presence or absence of the species at the site. It was recognised at the time that further surveys undertaken during spring or early summer would provide more robust data (Eco Logical 2008).

The absence of striped legless lizards during targeted searches for the species does not necessarily preclude the species from being present at the site. Techniques for detecting and tracking the species are known to be problematic and it is recognised that surveying grassland areas for the striped legless lizard can be expensive, time consuming and may produce little useful data (DSEWPC 2010). In case of Lawson South, however, repeated surveys, two of which were undertaken at a suitable time, did not record the presence of the species. It is most likely, therefore, that the striped legless lizard is not present within the Lawson South area and the proposed development would not impact on the species.

5.2 Regional Context

Prior to European settlement, habitat for the striped legless lizard (*Delma impar*) appears to have been mostly contiguous across the ACT covering approximately 20,000 hectares of natural temperate grassland (Environment ACT 2005). The current distribution of the species is fragmented as a result of past agricultural practices and urban development. To date, all large areas of potentially suitable habitat in the ACT have been surveyed for the species (Environment ACT 2005).

Figure 5.2 shows most of the locations within the ACT that have been surveyed for the striped legless lizard and indicates whether the species has been found within these areas. The information is relatively current but does not include the results for the 2010 lizard surveys which included the Lawson South area. The distribution of the striped legless lizard in the Canberra area as assessed by Conservation Planning and Research is summarised in Figure 5.3.

The site-specific data in Figure 5.2 show the general distribution of the species throughout the ACT and the North Canberra area and illustrates the strong preference of the species for grassland, rather than woodland, habitats. Apart from some records in Kenny, a short distance from the grassland boundary, the species appears to be absent from secondary grassland in the woodland areas that surround Gungahlin to the east, north and west. In North Canberra, a large proportion of the striped legless lizard records are within grassland habitat in the central to southern part of Gungahlin. These areas are considered to be key habitat for the species and the populations are conserved within the Crace Hill, Mulanggari and Gungaderra Grassland Nature Reserves (see Section 5.4). Habitat for the striped legless lizard has been protected in these grassland nature reserves. Approximately 400 hectares

of native grassland has been set aside to protect the striped legless lizard and other natural temperate grassland fauna species as well as the endangered natural temperate grassland community itself. The size of the populations within these reserves, however, has not been monitored recently.

Lawson South is located in Belconnen, north-west of Canberra city. Surveys for the striped legless lizard within Belconnen have found the species to be present in two small and isolated grassland areas. One of these areas is located immediately adjacent to Lawson South in the eastern part of the Commonwealth land in Lawson North (see Figure 5.1). At this site, five individuals were recorded in approximately 12.4 hectares of dry *Themeda* grassland during surveys carried out in 2001 (HLA 2002). The lizard has also been recorded in 28.2 hectares of *Austrodanthonia* grassland and native pasture, dominated by spear grass, to the east of the suburb of Kaleen (Environment ACT 2005, see Figure 5.3). Some of that grassland has since been removed for construction of the Gungahlin Drive extension.

The population at Kaleen is likely to have once been connected to a population at Crace Hill Nature Reserve which is located in the southern part of Gungahlin (see Figure 5.3). Elsewhere in Gungahlin, the striped legless lizard has been found in Nicholls and within and south of Kenny, with recent records confirmed in the latter area (Biosis 2011b, Moore et al. 2001).

East of the Canberra City, there is a large area of habitat within the Majura Valley which supports a population of the striped legless lizard that is known to be present in moderate densities. The habitat has been fragmented by the development of Majura Road but remains a core conservation site because of the presence of key threatened species habitat.

5.3 Striped Legless Lizard Habitat at Lawson South

The striped legless lizard has not been recorded within Lawson South during three different surveys for the species and it is most likely not present within the area. As discussed in Section 5.1, however, failure to detect the species in surveys does not absolutely mean that it is absent, or that migration into South Lawson from the adjoining habitat in North Lawson would not be a future possibility . Vegetation communities similar to those which provide habitat for the species elsewhere in the ACT are present in Lawson South.

The striped legless lizard is a grassland specialist known to occur in native grasslands, exotic pasture and secondary grassland within 2 km from a primary grassland site (ACT Government 2005). Despite a preference for grassland vegetation, the species may also occur in grassy woodland areas (Robertson and Smith 2010).

The important habitat features that appear to influence the persistence of the species within an area is the presence of a relatively dense and continuous vegetation structure, rather than the floristic composition of the grasslands, and the availability of shelter to protect the species during disturbance events such as fire, heavy grazing and ploughing (Robertson and Smith 2010). In the ACT, shelter is most

commonly provided by grass tussocks and spider burrows (DSEWPC 2010). Grass tussocks are also thought to provide the primary overwinter refuges.

Accurately mapping potential habitat for the striped legless lizard requires an in depth understanding of the species' ecology and habitat requirements and much of this information is still poorly known. One of the objectives of the National Recovery Plan is to determine the distribution of potential striped legless lizard habitat (Robertson and Smith 2010). Actions to assist in achieving this objective include determining whether the lizard can persist in the long term in exotic grassland that is isolated from native grasslands and undertaking research to determine the relationship between the structure and floristics of grasslands and the abundance of the lizard.

A conservative approach to mapping potential habitat within Lawson has therefore been adopted, incorporating all areas where the vegetation characteristics appear possibly suitable for supporting the lizard. Figure 5.4 shows the indicative boundaries of the known and potential striped legless lizard habitat within Lawson South and the adjacent area of Commonwealth land. Potential habitat has been classified into higher quality habitat or marginal habitat, based on vegetation quality and connectivity.

Within the Commonwealth land, all natural temperate grassland areas, including the area where the striped legless lizard has previously been recorded, have been mapped as higher quality potential habitat and the remnant yellow box – red gum grassy woodland community (secondary grassland) as marginal habitat. Within Lawson South, higher quality potential habitat areas include areas of native pasture and natural temperate grassland that are connected to the adjoining grassland in the Commonwealth land. Much of this is likely to have originally been natural temperate grassland. Secondary grassland, a patch of woodland, two isolated patches of native pasture and an area of exotic pasture that is regenerating with native grasses encompass the area mapped as marginal potential striped legless lizard habitat. In total, approximately 65 hectares of the Lawson South site contains vegetation that could potentially support the striped legless lizard. Approximately 28 hectares is considered to be high quality potential habitat and 37 hectares is considered to provide marginal habitat for the species.

It is important to note that the boundaries of known and potential habitat for the striped legless lizard within Lawson in Figure 5.4 are notional only and have been determined using a combination of survey results, existing vegetation mapping and information about the lizards ecology and its preferred habitat. The map should be interpreted with the knowledge that the boundaries are indicative only and there is possibility for a substantial margin of error. The mapped boundaries nevertheless correspond approximately with those used by Biosis (2011a) as a basis for identifying potential habitat for the most recent striped legless lizard survey, and any differences reflect the lack of precision inherent in assessing such boundaries.

5.4 Conservation Priorities and Habitat Fragmentation in North Canberra

The ACT Lowland Native Grasslands Conservation Strategy (ACT Government 2005) provides the strategic context for the ongoing protection, management and restoration of natural temperate grasslands and their threatened fauna components. The premise of the strategy is that protection in nature reserves and off-reserve conservation management of grassland habitat provides the foundation for long term

conservation of grassland fauna, including threatened species. The conservation objectives outlined in the conservation strategy for the striped legless lizard are to protect in perpetuity several viable populations of striped legless lizard in secure native grassland habitat across the range of the species in the ACT and to maintain the potential of the species for evolutionary development in the wild.

The main threats to the striped legless lizard are the continued loss and fragmentation of the grassland habitat due to agricultural, urban and industrial development and degradation of habitat through changed grazing intensity, pasture improvement, weed invasion, changed fire regimes and impacts of stock. Other threats include the impacts of predators (cats, foxes and birds of prey) and direct human disturbance (ACT Government 2005).

In North Canberra, the species has been recorded in two geographic locations, Gungahlin and Belconnen, across three catchment areas (see Figure 5.3). The species is thought to remain in six isolated populations within varied vegetation characteristics with all being separated by barriers such as major roads and residential development. These populations include those conserved within the Mulanggari, Gungaderra and Crace Hill Grassland Nature Reserves and those occurring in grassland paddocks in Kenny, Lawson North and Kaleen. Recent surveys in these areas have been undertaken in Kenny (including Block 799, Gungahlin) and Lawson South. One individual was found in Kenny (Biosis 2011b) and moderate numbers were found on Block 799, Gungahlin (Moore et al. 2011). No striped legless lizards were found in Lawson South. No recent surveys have been undertaken in the remaining areas to confirm the continued presence of the species at these sites.

Conservation of the striped legless lizard within the ACT is largely dependent on the conservation of its grassland habitat. Areas considered to be key habitat for the striped legless lizard (and other threatened grassland fauna) and of the highest conservation priority are those areas that contain large population numbers, large areas of habitat and higher quality habitat. These areas are considered to be more viable in the long term, more likely to retain their ecological condition and more likely to support reproducing populations. They are categorised within the Action Plan No. 28 as core conservation sites. Within North Canberra, three of these areas have been set aside as grassland nature reserves in Gungahlin to protect the striped legless lizard (and other threatened fauna) and the natural temperate grassland community as a whole (see Figure 5.3). The existing priorities for these areas are to improve the condition of these grassland habitats and provide ecological connectivity between the three grassland reserves.

Within the Belconnen area, specific conservation and planning issues related to the striped legless lizard include maintaining habitat for the species within the small fragmented areas in Kaleen and protecting areas that have natural values either as future nature reserves or other open space within the northern part of Lawson. The potential for protecting a viable habitat area in Belconnen appears to lie mainly in the Commonwealth land in Lawson North where there is an extensive area of natural temperate grassland with some previous records of the striped legless lizard. That is the area of highest priority for conservation of potential striped legless lizard habitat

in Belconnen, and should be large enough to maintain a viable population, subject to appropriate management.

5.5 Protection of Striped Legless Lizard Habitat within Lawson South

There is no known striped legless lizard habitat within Lawson South that requires protection within the Lawson South development. Figure 5.5 overlays potential habitat areas within Lawson South with the proposed development footprint. Approximately 59 hectares would be removed as a result of the residential development, infrastructure works, creation of wetlands and works within open space areas, consisting of 26 hectares of higher quality potential habitat and 33 hectares of marginal quality potential habitat. The remaining 6 hectares of potential habitat would not be substantially disturbed as a result of the development. Most of this is marginal habitat located on the upper slopes of Reservoir Hill and would be separated from the dry *Themeda* grassland on the Commonwealth land where the species has previously been recorded. About 1.7 hectares are within the buffer strip on the northern edge of the development adjoining the Commonwealth land.

Establishing an appropriate management regime for any areas of grassland protected at Lawson is an identified planning and conservation issue in Action Plan No. 28 (Environment ACT 2005). The offset package for the South Lawson development provides for exemplary management of striped legless lizard habitat at North Lawson. Regular monitoring of the population at North Lawson will also occur to guide adaptive management, ~~As discussed in Section 4.5, the management of these urban open space areas on Territory Land is the responsibility of the Parks and Conservation Section of Territory and Municipal Services and the specific management regime would be addressed at a later date. Given the known presence of the golden sun moth in these areas, it is likely that the grassland would be managed in a manner that is consistent with the management of this species rather than for the striped legless lizard. While habitat requirements are similar, the golden sun moth may require a shorter, less dense grassland coverage which may be a more desirable situation in an urban environment, particularly in relation to bushfire protection.~~

If it is decided to enhance any areas of potential striped legless lizard habitat within the Lawson South area, the most appropriate areas would be located in the north-eastern part of the site adjacent to the higher quality grassland on the Commonwealth land where the lizard has previously been recorded. Much of this area, however, would be affected by the development of the proposed wetlands, which are intended to improve the quality of water entering the Commonwealth land. The value of any residual habitat would be marginal, given the presence of much higher quality habitat to the north.

Should the striped legless lizard be found to be present in the natural temperate grassland in the western part of the Commonwealth land, appropriate management of the 30 metre buffer strip along the northern boundary of Lawson South may be beneficial in extending that habitat slightly. The primary management objective of this area, however, is as the Inner Asset Protection Zone for bushfire protection.

The potential for the Lawson South development to impact indirectly on any areas of potential striped legless lizard habitat that would be retained would include the temporary impacts that may result during the construction phase of the development. Appropriate site environmental management measures, such as sediment control measures, management of stormwater runoff and fencing of potential habitat areas to prevent unnecessary vehicle movements throughout the site, should mitigate such indirect impacts. The cat containment policy proposed for Lawson South and the ~~erection~~maintenance and where necessary construction of a dog proof and cat restrictive fence around habitat may reduce the risk of predation on reptiles, including the striped legless lizard ~~if it is present~~in North Lawson..

6. NATURAL TEMPERATE GRASSLAND

6.1 Existing Environment and Impacts

Two areas within Lawson South have been identified as containing small patches of natural temperate grassland belonging to the endangered Natural Temperate Grassland of the Southern Tablelands endangered ecological community (Eco Logical 2008, see Figure 6.1). One of these patches, covering about 0.25 ha, is located on the southern slopes of Reservoir Hill and would be completely impacted by the proposed development. The other patch of about 1.1 hectares is located on the northern boundary of the Lawson South area, and is to be largely retained within a 30 metre ecological buffer zone separating Lawson South from the higher quality Commonwealth land to the north (see Figure 6.1). The patch to be conserved is approximately 0.6 hectares in size and is dominated by wallaby grasses and some disturbance tolerant native forbs. The edge of this patch is not well defined, and merges into native pasture which has a low forb diversity. The native pasture and some of the natural temperate grassland would be impacted by the proposed development.

6.2 Management of the Natural Temperate Grassland Endangered Community

The natural temperate grassland that would be retained would be managed to protect the ecological value of the endangered grassland community and the fauna species, particularly the golden sun moth, which it supports. It would provide a buffer to the natural temperate grassland in the BNTS and would be a potential extension of that area. The primary management issues include the timing and frequency of mowing and slashing within the buffer zone for bushfire management, the management of weeds and in particular, those that may be planted within residential gardens and have the potential to become environmental weeds, and the landscaping associated with the grassland areas within the development.

Management of the natural temperate grassland within the buffer area and the remainder of the buffer area would require an adaptive approach depending on the seasonal conditions. There are, however, some general management measures that would be implemented to protect the value of the grassland, regardless of the conditions. These could include the following:

- Weeds in the buffer zone would be controlled through broad scale or spot spraying.
- If possible, slashing and/ or mowing would be avoided during the golden sun moth flying season which is between October and December (inclusive) each year, although this would depend on fire management requirements.
- Tree planting would be avoided within or in close proximity to the natural temperate grassland area.
- Road verges and any other sites requiring rehabilitation close to the northern boundary of the suburb would be rehabilitated with native seed collected from the adjacent natural temperate grassland area within Lawson North, if available, or otherwise from a suitable alternative source.

- New residents would be informed (e.g. through a brochure) of the value of the grassland within the buffer area and the BNTS site and of the choice of appropriate garden landscaping species.

Further management details of the natural temperate grassland within the buffer zone would be the responsibility of the Parks and Conservation Section of the Territory and Municipal Services department of the ACT Government. The specific details of the management regime would be addressed at a later date.

7. COMMONWEALTH LAND

7.1 Existing Conditions and General Impacts

7.1.1 Scoping assessment

Commonwealth land, managed by the Department of Defence, is located adjacent to the northern boundary of the Lawson South site. The land is the former site of the BNTS and comprises 143 hectares, 115 hectares of which is located within a secure fenced area (see Figure 7.1). The site contains features of natural, cultural and heritage significance. This includes the presence of threatened flora and fauna species and endangered ecological communities that are listed under both the *EPBC Act* and the *NC Act,* eight Aboriginal sites and historic buildings associated with the former BNTS site.

The Commonwealth land would not be directly impacted on as a result of the residential development of Lawson South, however, given the close proximity of this land to the development area, there is potential for it to be indirectly impacted upon in the long term. To identify the most likely potential indirect environmental impacts on the Commonwealth land as a result of the proposed Lawson South development, a scoping assessment of all environmental issues was undertaken. This scoping assessment is summarised in Table 7.1.

Table 7.1 Summary of scoping assessment of impacts on Commonwealth land

Environmental Issue	Impact on Commonwealth land of proposed Lawson South development			Comments
	None	Low	High	
Removal of native vegetation	✓			
Loss of habitat	✓			
Loss of threatened species habitat	✓			
Loss of threatened plants	✓			
Fragmentation of habitat	✓			
Introduction of exotic plants		✓		There is the potential for the grassland quality to be reduced through invasion of environmental weeds planted in Lawson South residential gardens, or that
Introduction and or increasing populations of exotic animals		✓		
Wildlife mortality	✓	✓		
Modification of animal behaviour	✓			

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Table 7.1 (continued)

Environmental Issue	Impact on Commonwealth land of proposed Lawson South development			Comments
	None	Low	High	
Introduction of animal predators including domestic pets	✓			The perimeter of much of the Commonwealth land is fenced thus restricting any opportunity for dogs to access the site. The Lawson South residential development will be subject to the ACT Government cat containment policy.
Soil disturbance and erosion		✓		Most of Lawson South is designed to drain away from the Commonwealth land. Elsewhere appropriately managed stormwater runoff during the construction phase of the development would minimise the risk of soil disturbance and erosion occurring on Commonwealth land.
Landform modification	✓			
Water quality/ aquatic habitat		✓		Beneficial impact due to wetland treatment of existing runoff from Kaleen.
Geotechnical impacts	✓			
Contaminated land	✓			
Changes to microclimate	✓			
Altered hydrological regimes		✓		As most drainage from Lawson South is directed away from the Commonwealth land, alterations to the hydrological regime would be minor.
Drainage changes		✓		As above. The design of the stormwater capture system will limit any changes in drainage through the land.
Increased risk of flooding	✓			
Air quality	✓			
Traffic impacts	✓			
Noise and vibration – ongoing	✓			

Table 7.1 (continued)

Environmental Issue	Impact on Commonwealth land of proposed Lawson South development			Comments
	None	Low	High	
Views from the Commonwealth land			✓	The visual impact on the Commonwealth land of parts of the Lawson South development may not be important while public access to the area is restricted, but may become so in the future if the area becomes a public nature reserve and heritage precinct. Views from the Commonwealth land have been addressed in the master plan for Lawson South.
Aboriginal cultural heritage impacts	✓			
European cultural heritage impacts	✓			
Geological heritage	✓			
Land use impacts – general	✓			
Effects on recreational uses	✓			
Effects on educational and scientific uses	✓			
Access/ accessibility	✓			
Property values	✓			At present the Commonwealth land does not contain any private properties.
Other economic effects		✓		Development of Lawson South may influence the economics of developing adjacent parts of the Commonwealth land, but it is not feasible to assess this in detail.
Waste management	✓			
Wastewater management	✓			
Use of hazardous goods	✓			
Generation of hazardous waste	✓			
Water use	✓			
Resource demand	✓			
Existing services and infrastructure	✓			
Safety issues	✓			
Bushfire risk			✓	Bushfire risk to Lawson South may have implications for how adjacent parts of the Commonwealth land are managed.

Table 7.1 (continued)

Environmental Issue	Impact on Commonwealth land of proposed Lawson South development			Comments
	None	Low	High	
Energy implications	✓			
Construction impacts		✓		Construction impacts include potential sediment runoff onto Commonwealth land. A construction environmental management plan would be developed to manage this issue. The buffer area along the northern edge would assist in protecting Commonwealth land during the construction period.
Climate change implications	✓			

The most likely potential impacts on the Commonwealth land include the following:

- Impacts associated with changes in water runoff patterns through the Commonwealth land, including sedimentation during and following construction.
- The risk of introducing weeds to the high quality natural temperate grassland in the Commonwealth land through invasion by garden escapees planted in Lawson South, or through weeds flourishing in disturbed areas within Lawson South.
- The risk of introducing or increasing local populations of exotic animals such as Indian Myna that thrive in urban situations but may range into the neighbouring grassland;
- Implications for fire management and recreational planning within the Commonwealth land.
- Visual impacts of the residential development.

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These impacts would not necessarily be adverse, and are discussed further in the following sections.

7.1.2 Impacts associated with runoff

The majority of the runoff in Lawson South flows in a south-westerly direction away from the Commonwealth land and drains into College Creek and/or Lake Ginninderra. The existing topography means there is very little runoff from the Territory land onto Commonwealth land and so any alterations to current conditions would be minor in the context of the whole Lawson environment.

There is a small catchment in the east of Lawson South where surface runoff from the Territory land in Lawson South currently passes through the Commonwealth land before draining into the Kaleen/ Giralang stormwater channel. It is proposed to

construct a wetland inside the northern boundary of Lawson South to control this flow at pre-development levels and improve its quality before it enters the Commonwealth land. That wetland, together with a second wetland located closer to Baldwin Drive, would also receive inflows from an area of Kaleen which is currently discharging runoff into the Lawson area and then into the Commonwealth land, without any treatment. The wetland system is expected to improve the quality of this runoff before it enters the Commonwealth land. It is therefore intended that the wetland would improve the quality and regulate the flow of runoff from small areas in both Lawson South and Kaleen, resulting in a net environmental improvement within the Commonwealth land, despite the additional development in the catchment.

7.1.3 Introduction of weeds

The chance of introducing weeds and potentially invasive species into the high quality natural temperate grassland through invasion by garden escapees from Lawson South is possible, but the risk of reducing the value of the grassland would not be substantially higher than that which currently exists today. The Commonwealth land is partly surrounded by developed urban areas and, to date, has managed to maintain its high quality ecological characteristics. The existing grazing land within Lawson South also contains a component of agricultural weeds, which would be reduced following development. Education and awareness programs that inform new residents of the ecological value of the adjacent grassland and provide advice on appropriate garden landscaping species will assist in mitigating any impacts.

Significant environmental weeds, such as Chilean Needle Grass and African Lovegrass, will flourish as a result of the disturbance created in the building and functioning of a residential area. This may dramatically increase the seed flow and likely invasion of weed species into Lawson North.

The master plan for Lawson South (see Figure 2.3) provides for a 30 metre ecological buffer that would separate the residential development at Lawson South from the Commonwealth land. This buffer would be managed to protect the natural temperate grassland community and some of the golden sun moth habitat that is present within Lawson South. It has primarily been established to minimise any impacts on the threatened species and ecological communities that exist within the Commonwealth land, and should act as a buffer to the spread of weeds from Lawson South.

The offset package, detailed at X.X also includes funding for exemplary weed management within North Lawson.

7.1.4 Introduction of ruderal animal species

"Ruderal" species (those that thrive in urban areas) such as the Indian Myna, house mouse, European wasp or Portuguese millipede may increase their local populations as a result of urban development at South Lawson. These animals may have negative impacts on surrounding non-urban areas. For example, Indian Mynas which breed and roost in neighbouring suburbs of Chifley and Pearce have been observed feeding on the threatened Perunga grasshopper within the adjoining Mt Taylor Nature Reserve.

The offset package allows such impacts to be minimised through the establishment of a dedicated Ranger position, which would be able to instigate control measures for ruderal species found to be impacting Lawson North.

7.1.4 Bushfire protection

The proposed 30 metre buffer strip along the northern edge of Lawson South would serve also as part of an inner asset protection zone (IAPZ) for bushfire protection for Lawson South in accordance with ACT legislative requirements. This area would be managed through mowing to reduce the grass fuel load immediately adjacent to the proposed development.

In addition, a less intensively managed outer asset protection zone (OAPZ) is required to extend for up to a further 100 metres, although ~~this~~ the extent within North Lawson ~~may~~ will be slightly less ~~be reduced~~ due to the presence of edge roads between the IAPZ and the residential boundary. Under the proposed master plan, ~~this~~ between 85-95m of OAPZ would need to be located within the Commonwealth land along the northern boundary of Lawson South, except in any areas of the Commonwealth land which may also be subject to residential development. The main implication of the OAPZ is that it would need to be managed to maintain acceptable fuel levels. Some of this zone is already totally cleared for a bushfire management track. If adequate fuel management within the rest of the OAPZ was not achieved by grazing, it ~~would~~ may be necessary to undertake slashing during the bushfire season, fuel reduction burns or other fuel reduction measures. The management requirements would vary according to seasonal conditions. The ecological implications of such management are discussed further in Section 7.2.2.

It is understood that the Department of Defence currently manages the perimeter of the BNTS site for bushfire protection purposes. The Department of Defence has recently advised that they would issue a licence to allow the Territory to manage the southern perimeter of the Commonwealth land to a depth of 100 m for bushfire protection. The bushfire management requirements in relation to Lawson South therefore would not represent a significant change from the existing management regime.

There is an apparent conflict between the proposed development of Lawson South and the Development Control Plan (DCP) for the BNTS (Australian Government 2010), in that the DCP states that any asset protection zone required in relation to bushfire protection for urban areas must not be located in the precincts identified primarily for nature conservation. A strict interpretation of this condition would mean amending the current master plan to enable both the IAPZ and the OAPZ to be accommodated within the Lawson South boundary.

This condition, however, appears to be anomalous in relation to the DCP itself, as it would also preclude any viable residential development within the Commonwealth land, as proposed in the DCP. On the assumption that this is not intended, it has been assumed for purposes of the Lawson South Master Plan that the above condition applies only to the IAPZ, pending further clarification to the contrary. The ecological implications of maintaining the OAPZ within the Commonwealth land are discussed in Section 7.2.2.

7.1.6 Recreational Impact

Locating 1400 dwellings next to and generally overlooking the BNTS may create a pressure for public recreation within the BNTS which will need to be managed. The current man-proof fence provides a certain level of protection from recreational pressures but its integrity will need to be maintained. The offset package includes funding to extend and maintain the current fencing. Recreational pressure within BNTS will be lessened through the provision of open space and recreational facilities within South Lawson, while recreational use of Lawson North will be considered as part of reserve planning and restricted to sustainable uses, which may include open days or other means of limited access.

7.1.5 Visual impacts

Development on the northern slopes of Reservoir Hill would be visible within Lawson North, changing the appearance of the slope from rural to urban. This may not be of concern while public access into Lawson North is restricted, but would become more relevant once the BNTS site becomes publicly accessible as a nature reserve.

The visual impacts of urban development upslope are an unavoidable consequence of urban native reserves which are located on lowlying land, and is exacerbated by such reserves often being naturally treeless, making any surrounding development highly visible.

The visual impacts of the development overlooking the BNTS site may also be considered to conflict with some of its cultural heritage values, as described in

Section 7.3. This factor, however, has been taken into account in the design for the Lawson South Master Plan, which maintains view corridors into and out of the site. This design is intended to enable a continued 'reading' of the landscape as both Reservoir Hill and Black Mountain would be seen. Also, the historic windbreak would be kept to maintain a link with the windbreak in the BNTS, and the former travelling stock route would also be maintained.

7.2 Ecological Values of the Commonwealth Land

7.2.1 Threatened species and ecological communities

The grassland within the Commonwealth land is one of the core conservation sites for natural temperate grassland within the ACT (Environment ACT 2005) and is one of the most important golden sun moth sites in North Canberra. It is one of eleven natural temperate grassland sites within the ACT that is larger than 100 hectares (Cooper 2009). The following threatened or migratory species and endangered ecological communities have been recorded within the Commonwealth land:

- golden sun moth;
- striped legless lizard;
- perunga grasshopper (*Perunga ochracea*);
- Ginninderra peppercress (*Lepidium ginninderrense*);
- Natural temperate grassland of the Southern Tablelands;
- White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grasslands ecological community;
- Latham's snipe (*Gallinago hardwickii*); and
- Grey-headed flying fox (*Pteropus poliocephalus*).

Figure 7.1 indicates the known distribution of most of these species and communities on the Commonwealth land. Each is discussed briefly below.

The **golden sun moth** is listed as critically endangered under the *EPBC Act* and endangered under the *NC Act* and the Commonwealth land supports a core population of golden sun moth within the ACT. The grassland habitat is listed on the Commonwealth Heritage List and the Register of the National Estate on the basis of its conservation value for the species.

The preferred habitat of golden sun moth is generally natural temperate grassland dominated by wallaby grasses. This vegetation is present throughout much of the Commonwealth land. Within the ACT, the species has also been found in native pasture, degraded native pasture, secondary grassland and the invasive weed species Chilean needle grass.

Numerous golden sun moth surveys and vegetation surveys have been undertaken on the Commonwealth land since 1995 to identify the extent of golden sun moth habitat throughout the site, which has been assessed as supporting the largest population of the golden sun moth within the region (ACT Government 2005). Figure

7.1 shows the known golden sun moth habitat throughout the site. This covers an area of approximately 85 hectares.

The **striped legless lizard** is listed as vulnerable under the *EPBC Act* and was recorded in dry *Themeda* natural temperate grassland in the south-eastern part of the Commonwealth land during targeted surveys in 2002 (see Figure 7.1). A total of four lizards were found. Key habitat for the species appears to be native grasslands dominated by perennial, tussock forming grasses such as kangaroo grass, spear grasses and wallaby grasses, although the species has also been recorded in some areas within the ACT that are dominated by exotic grasses.

The **perunga grasshopper** is not listed as a threatened species under the *EPBC Act* but is listed as vulnerable under the *NC Act*. There are several records of the species occurring within the Commonwealth land since it was first identified at the site during 1997 – 1998 (ACT Government 2005). It was also recorded in *Themeda* grassland on the ACT Government land east of the Commonwealth land (Rowell 2003). Generally, the habitat for the perunga grasshopper appears to be consistent with that of the golden sun moth.

The **Ginninderra peppercress** is listed as vulnerable under the *EPBC Act* and endangered under the *NC Act* and the only known population of the species exists in the north-west corner of the Commonwealth land (ACT Government 2005). Figure 7.1 shows the area within the Commonwealth land where the plants are scattered throughout. Approximately 2000 plants are estimated to occur at the site within an area of 0.0027 square km (Australian Government 2005). A few of the plants have been surrounded by a fence to protect them from vehicle movements and slashing, and a larger number are scattered through damp grassland nearby (Rowell 2003). Critical habitat for the Ginninderra peppercress has been identified under the *EPBC Act.* The area covers about 20 hectares within the Commonwealth land at Lawson and is shown on Figure 7.1.

Natural temperate grassland is listed under both Commonwealth and State legislation as an endangered ecological community and covers approximately 120 hectares of the Commonwealth land mostly within a secure fenced area. The area is identified as one of the core grassland areas for conservation within the ACT, is in very good condition and supports one of the largest populations of the golden sun moth within the ACT. The boundaries of the endangered grassland community are shown in Figure 7.1.

A 2008 assessment (SMEC 2008) of the remnant woodland patch that is located in the south of the site adjacent to the Lawson South residential development boundary against the *EPBC Act* criteria, identified the patch as belonging to the listed endangered **White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands ecological community** (see Figure 7.1). The patch contains remnant yellow box and Blakely's red gum woodland trees above a species-rich understorey of native grasses, herbs and scattered shrubs. While the understorey contains a large amount of weeds, there is quite good regeneration in the shrub layer indicating that the site could regenerate to a good condition in time.

Latham's snipe is a migratory bird that breeds in the northern hemisphere and migrates to Australia during its non-breeding time. It generally arrives in south-eastern Australia between August and January and leaves between late February and early March.

In Australia, it occurs in a wide variety of permanent and ephemeral wetlands. They generally inhabit open freshwater wetlands that have low dense vegetation nearby providing shelter for the species but are also known to occur in habitats that have saline or brackish water. They can occupy modified and artificial habitats and can occur in sites close to humans or human activity (Australian Government, n.d).

During a January 2008 ecological survey, four individuals were observed in the riparian vegetation on the Lake Ginninderra foreshore (SMEC 2008). On the three occasions the individuals were observed, they were either roosting within the tall reeds on the edge of the creek or in the surrounding low grassland (SMEC 2008) that provides potential habitat for the species.

The **grey-headed flying fox** is the largest of the Australian fruit bats and is listed as vulnerable species under the *EPBC Act*. One individual was recorded flying over the site during nocturnal surveys conducted by SMEC in January 2008 and was thought to be foraging on the planted fruit trees and eucalypts present within the old housing estate (SMEC 2008).

In general, the biodiversity values of the Commonwealth land are substantially greater than those of Lawson South, these values being associated predominantly with the large area of natural temperate grassland within the area. The future management of this grassland is an important consideration in the overall planning for the suburb of Lawson.

7.2.2 Impacts on threatened species and ecological communities

The scoping assessment in Section 7.1 did not identify any direct impacts on threatened species or ecological communities within the Commonwealth land as a result of the development of Lawson South. There is the possibility of some indirect effects, however, as a result of weed introduction or bushfire management. As identified in Section 7.1.2, any potential impacts on hydrological processes are likely to be minor or beneficial.

The main impact of weed introduction is likely to be on the botanical integrity of the natural temperate grassland. Weed control will be a management issue for this grassland irrespective of the nature of development in Lawson South because of the proximity of other surrounding suburbs and the existing weed content in pasture in Lawson South. Subject to an appropriate management regime, this is unlikely to become a significant problem in the future. The risk of weed introduction and the management measures to control it in proximity to the Lawson South boundary are not likely to have significant impacts on any of the individual threatened species within the grassland.

The development of Lawson South in accordance with the Territory Plan and the LDA Master Plan, as well as in accordance with the residential development

provisions of the NCA Development Control Plan would necessitate the management of parts of the natural temperate grassland as an OAPZ for bushfire protection. In some years, seasonal conditions and grazing by kangaroos may limit grass growth within the OAPZ to an adequate level for bushfire protection. In other years, active management, probably involving slashing to a minimum height of 300 mm, may also be required.

In order to minimise the risk of weed invasion as a result of any slashing activities, it would be important for any slashing equipment, which has the potential to transport weeds such as African love grass or Chilean needle grass, to be cleaned before it is brought onto the site. With this precaution, the main impact of slashing to OAPZ fire protection requirements is likely to be temporary physical modification to the structure of the natural temperate grassland, reducing the height of the grass and increasing the cover of thatch (cut grass) on the ground.
If the thatch layer is not too dense (or, alternatively, if most of this can be removed), this could be beneficial for the golden sun moth in opening up the grass layer and facilitating the search for female moths by males. Otherwise, if slashing is undertaken prior to the moth flying season (e.g. by mid October), it is unlikely to have adverse effects on the golden sun moth.

Controlling the density of the grassland may also be beneficial for the striped legless lizard, if it is present within the OAPZ. However, the only striped legless lizard records to date have been in the dry *Themeda* grassland to the east of the Lawson North area, and the species has not yet been surveyed in the main natural temperate grassland area that abuts Lawson South, where bushfire protection measures would be most critical. It is therefore uncertain whether this species would be affected by fire protection management along most of the Lawson South boundary.

In summary, the need to manage some of the natural temperate grassland within the BNTS as an OAPZ would not necessarily have a significant adverse effect on the grassland or the species that it supports, and may actually be beneficial under circumstances when the fire protection needs are greatest. The requirement in the DCP to exclude the OAPZ from the natural temperate grassland area is not supported on ecological grounds, based on the above assessment.

Possible evidence to support the value of avoiding excessive grass growth with natural temperate grassland comes from observations at Yarramundi Reach where such grassland has been excluded from grazing or other intensive management for many years. This site previously supported the golden sun moth and the striped legless lizard, but both of these species no longer appear to be present (ACT Government 2005, Hogg 2011b). There is a view that dense grass growth may have contributed to their decline.

As the grassland management issues within Lawson North are currently a Commonwealth responsibility, it is not possible at present for the ACT Government to make a firm commitment towards their implementation. The assessment of any impacts (adverse or beneficial) is therefore provisional, based on the assumption that the area would be managed appropriately.

The natural temperate grassland in the BNTS shares a common boundary with much of the northern edge of Lawson South. The 30 metre wide ecological buffer and IAPZ follows this boundary and would assist in reducing the direct and indirect impacts of the Lawson South development on the threatened species and ecological communities within the BNTS. This interface would also provide strong connectivity between the habitat areas retained within Lawson South and those in the BNTS, increasing the effective size and viability of the latter.

7.3 Heritage Values of the Commonwealth Land and Potential Indirect Impacts

A Heritage Management Plan of the BNTS site was prepared by Godden Mackay Logan for the Department of Defence in May 2009 (Godden Mackay Logan 2009). The report identified historic, natural and cultural values on the site. These are summarised in the Table 7.2.

Table 7.2 Heritage values on Commonwealth land

HERITAGE VALUE	ITEM
Natural	Natural temperate grassland Yellow box –red gum grassy woodland and derived native grassland Golden sun moth Striped legless lizard Ginninderra peppercress Perunga grasshopper Latham's snipe
Historic context	Aboriginal occupation Pastoral land use The military era Post war expansion and consolidation of transmitting facility Decommissioning and demolition
Historic heritage	The transmitting station The site of the aerial array and copper earth mat Outbuildings The guardhouse The senior sailors' mess Site of the naval village Travelling stock route The radio transmitting technology
Indigenous	4 isolated finds (L08, L09, L19, L20) 3 artefact scatters (L01, L02, L11) 1 possible scarred tree (L12) 8 areas of potential archaeological deposits (AAP, L01PAD, L02 PAD, L11PAD, L20PAD, L PAD 1, L PAD 2, L PAD 3)

The indirect impacts on the natural heritage values have been discussed in Section 7.2.2 and concluded that there would be no indirect impacts on any threatened species or endangered ecological communities that occur on the Commonwealth land.

Apart from the visual impacts on the surrounding landscape, the development of Lawson South would not impact indirectly on the remaining cultural heritage values of the site. Indigenous values and the historical context of the site would remain unchanged and unaffected. The physical evidence of the site's past land uses, such as a fenced portion of the original travelling stock route and the remaining building of the transmitting station and naval village, are the only items that could potentially be indirectly impacted by the development, however, these are located within an area that is secure and where public access is currently restricted. The potential for these heritage places to be subject to damage or looting is very low and the development of Lawson South would not increase this risk. It could be argued that residential development on the southern boundary of this land could improve the protection of these sites through the increased presence of people within the vicinity.

The heritage relationships between the BNTS and the land in Lawson South have been recognised in the planning for Lawson South. Specifically, the historic windbreak and travelling stock route which link the two areas would be retained, together with view corridors towards Reservoir Hill and Black Mountain. The upper slopes of Reservoir Hill, where the former water supply for the BNTS was located, would be kept free of residential development.

Indirect impacts on the heritage values of the Commonwealth land are much more relevant to the development of parts of this land, rather than to the development of Lawson South. This future development is currently the subject of an independent planning process. While development within Lawson is likely to lead to the land becoming more accessible from the south, future users of the area are likely to come largely from other surrounding suburbs and other parts of Canberra, as well as from Lawson South.

7.4 Protection of Commonwealth Land in the Long Term

As discussed in Section 7.2.2 and 7.3, the Lawson South development is not likely to result in any indirect impacts to the environment on Commonwealth land in the short or long term. In an investigation of lowland native grasslands in the ACT by the Commissioner for Sustainability and the Environment, it was recommended, however, that prior to Lawson South being developed for residential purposes, a long term grasslands management plan covering the BNTS be developed (Cooper 2009). The management plan should incorporate clear management objectives and be based on an adaptive management approach to protect the grasslands, golden sun moth, perunga grassland and Ginninderra peppercress at the site. The following issues may be incorporated into the plan:

- Management and/or restriction of public access to the Lawson North site
- Protection and monitoring of the quality of the natural temperate grassland at the site
- Protection and monitoring of the golden sun moth population
- Protection and monitoring of other species and ecological communities of significance at the site
- Monitoring and review requirements for the management plan

- Protection and management of the identified heritage values, including Commonwealth Heritage values, of the former BNTS in accordance with the policies of the management plan '*Belconnen Naval Transmitting Station, Lawson, HMP',* prepared for the Department of Defence by Godden Mackay Logan, May 2009.

A recent referral submitted to the Minister for the Environment to undertake remediation activity on the Commonwealth land in preparation for the potential future sale of the land (*EPBC* 2008/4367) requires the Department of Defence to ensure the purchaser of the BNTS enters into a conservation agreement with the Minister to conserve and maximise the protection of natural values of the area, in particular the Natural Temperate Grassland endangered ecological community and Commonwealth listed threatened species such as the Ginninderra peppercress, golden sun moth and striped legless lizard, prior to the sale of this site. The management plan recommended by the Commissioner may form the basis for such a conservation agreement.

The responsibility for the development of the conservation agreement currently lies with the Commonwealth Government. In the absence of an intended purchaser of the Commonwealth land at this stage, it is unlikely that the preparation of this conservation agreement would occur prior to the commencement of the Lawson South development.

8. OFFSET PACKAGE

The ecological studies undertaken for Lawson demonstrate that the greatest biodiversity assets lie within the natural temperate grassland in the Commonwealth land in the northern part of Lawson. This area of 120 hectares is assessed in the ACT Lowland Native Grassland Conservation Strategy (ACT Government 2005) as one of the core conservation sites (Category 1) for natural temperate grassland in the ACT. In contrast, the Lawson South area has been assessed as category 3: landscape and urban sites, which have lower conservation value but may still contribute to conservation of grassland biodiversity, for example, as buffers or landscape features within the urban fabric. Lawson North contains a much larger area of natural temperate grassland than Lawson South, is assessed as key habitat for the golden sun moth and the button wrinklewort, and contains several other threatened species, including the Ginninderra peppercress.

The botanical significance rating of the Lawson North grassland has previously been assessed as Level 2 on a 1 to 5 scale where 1 is highest and 5 is lowest, while Lawson South was rated as Level 5 (ACT Government 2005). The Lawson North area was also reported as supporting the largest population of the golden sun moth in the region (ACT Government 2005), while surveys in Lawson South have recorded at most only moderate levels of golden sun moth activity. This difference may reflect the fact that Lawson North contains predominantly natural temperate grassland, which is the preferred habitat for the species, while Lawson South contains predominantly secondary grassland.

The natural temperate grassland in Lawson North is offered as a long term offset in terms of land contribution against the Lawson South development. The percentage of the land in Lawson North attributed to the Lawson South offset should be determined based on the relative ecological quality of the grassland in the two areas. Taking account of the principle that offsetting should result in a net gain for biodiversity conservation, it is proposed the offset should be determined as follows:

- The offset should be based primarily on the area of golden sun moth habitat impacted within Lawson South. This would include the small patches of natural temperate grassland.
- Because of the differences in ecological quality, a significant net gain would be achieved by offsetting one hectare of known habitat in Lawson North against the development of one hectare of known habitat or two hectares of potential habitat in Lawson South.

As 32 hectares of known habitat and 16 hectares of potential habitat would be impacted, this would result in an offset of 40 hectares of golden sun moth habitat within the natural temperate grassland in Lawson North. The remaining 45 hectares of golden sun moth habitat or 80 hectares of natural temperate grassland within Lawson North would remain available as an offset against other future development.

An existing limitation faced by the ACT Government on implementing such an offset arrangement is that the land is currently owned by the Commonwealth Government. The site is surplus to Department of Defence and there is an expectation within the ACT Government and Department of Defence that the land will eventually pass to

the ACT Government and become a nature reserve. However, this will need to take place for the above offset arrangement to be implemented. There is currently no firm timeline for this to occur.

In the meantime, retaining the exceptional values of the grassland within the BNTS site will require an ongoing management commitment. It is therefore proposed that as a short term offset to the development of Lawson South, the ACT Government would contribute funding towards the enhancement of the biodiversity values of Lawson North. As this process is likely to extend over several years, one possible mechanism for implementing an offset at the time of development of Lawson South would be to establish a trust fund based on a contribution from the estate developer. The fund would be drawn on as required to finance management, enhancement, research and monitoring activities beyond the basic level of site management, with a view to maximising the value of the Lawson North grasslands as a nature reserve.

The LDA has proposed that an amount of $300,000 be offered as an indirect offset towards biodiversity management in Lawson North. As the area is already fenced, it is not expected to require a significant amount of capital expenditure as part of the site management, leaving the full amount for on-ground management of the area.

The above offset package would be consistent with the draft policy statement on offsets prepared under the *EPBC Act* (Department of Environment and Water Resources 2007). It is likely to lead to a better biodiversity outcome than the possible alternative of withdrawing a large area of poor quality golden sun moth habitat from rural lease elsewhere in the ACT, in the hope that this habitat may improve in ecological value with a minimal level of management.

Possible mechanisms for addressing the short-term management actions prior to transfer of the land from the Commonwealth to the ACT Government are as follows:

1. The ACT Government could provide funds to enable the Commonwealth Department of Defence to be responsible for management of the land on an interim basis. This in turn may result in the Department of Defence contracting the management back to an appropriate section of the ACT Government.

2. A simpler variation to the above would be for the Department of Defence to grant access to the ACT Government to undertake the management of the site in accordance with an agreed management regime.

3. If one of the above arrangements cannot be negotiated with the Department of Defence, an immediate offset may be implemented in relation to an alternative area (e.g. one of the grassland nature reserves in Gungahlin) under an arrangement whereby an offset for another development would be directed to the management of Lawson North when this becomes practicable in the future. A disadvantage of this option, however, is that the quality of the natural temperate grassland at Lawson North may deteriorate in the meantime, while the transition from Commonwealth to ACT Government control is being resolved, unless the Commonwealth implements an appropriate management regime.

Further details of any offset package would be negotiated once the principles of that package were agreed between the ACT Government, DSEWPC and the Department of Defence.

9. CONCLUSIONS

The development of land within Lawson South would impact on two small areas of natural temperate grassland and a high proportion of a large area of native pasture/ secondary native grassland habitat which supports a low density population of golden sun moths. The total area of natural temperate grassland directly impacted is approximately 0.75 ha. The total area of known golden sun moth habitat impacted would be of the order of 32 ha, with a further 16 hectares of potential habitat also impacted. These area estimates, however, are very approximate because of the difficulties in accurately delineating habitat boundaries, and uncertainties about possible development impacts outside the footprint shown in master plan in Figure 2.3. It is therefore not appropriate to apply these figures on an accurate mathematical basis for proposing environmental offsets to the proposed development.

Instead, it is recommended that the identification of potential offsets be approached in the wider context of the whole of Lawson, taking account of the relative biodiversity values of the various parts of the area. In this respect, the natural temperate grassland within the BNTS in Lawson North is clearly the most ecologically significant area within Lawson. From a strategic biodiversity conservation perspective, the highest priority should be given to maintaining and enhancing that area for its diverse biodiversity values.

The opportunity for the ACT Government to implement conservation measures in this area is currently limited because the area is currently Commonwealth land. This fact does not alter the importance of managing the area for its biodiversity values, and there are several possible administrative arrangements that could be considered to achieve this in the short term, with a view to the BNTS area eventually becoming an important grassland nature reserve managed by the ACT Government.

As the Lawson North area is currently Commonwealth land, it is necessary also to consider any impacts of the Lawson South development on that area. The most obvious of these is likely to be the visual impact of residential development on the slopes overlooking the BNTS site. This has been addressed in the Lawson South Master Plan. The issue of bushfire management in relation to both Lawson South and proposed residential development within Lawson North needs to be clarified because of an apparent inconsistency in the NCA Development Control Plan for the area. Neither of these issues, however, would necessarily impact significantly on the biodiversity values of the Lawson North area, and the bushfire management measures, if undertaken with appropriate safeguards, may be beneficial from a habitat management perspective. Other indirect impacts on the Commonwealth land are capable of being managed to avoid significant adverse impacts, and could be beneficial in relation to water quality.

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APPENDIX A

PRELIMINARY DOCUMENTATION. SPECIFIC CONTENT OF THE ADDITIONAL INFORMATION

The following table details the specific additional information requested by DSEWPC and indicates where this information is addressed in the Preliminary Documentation.

Item	Section, Figure number
1. Impacts on listed threatened species and ecological communities	
Golden sun moth (GSM)	
Information, including contextual mapping, about the regional context of GSM habitat in North Canberra	Section 4.2, Figures 4.4 and 4.5
Mapping depicting all relevant GSM survey transects undertaken at Lawson South to date	Section 4.1, Figure 4.1
A map depicting GSM survey results overlaid with known and potential GSM habitat at Lawson South, including calculation of hectare area/s	Section 4.1, Figure 4.2
A map of known and potential GSM habitat at Lawson South overlaid with the proposed development footprint (including various development options if relevant)	Section 4.1, Figure 4.3
A discussion about conservation priorities and fragmentation of GSM habitat in North Canberra	Section 4.4
A discussion about GSM habitat that is proposed to be retained at Lawson South, including information on how the remaining GSM habitat is proposed is proposed to be managed to: • mitigate indirect impacts on GSM; and • maintain or potentially improve the quality of GSM habitat.	Section 4.5
Striped legless lizard (SLL)	
Information, including contextual mapping, about the regional context of SLL habitat in North Canberra	Section 5.2, Figures 5.2 and 5.3
A discussion about the survey/s conducted for the SLL at Lawson South, including information about the appropriateness of the timing of the survey/s	Section 5.1, Figure 5.1
A map of potential SLL habitat at Lawson South, that also depicts known and potential SLL habitat on adjacent Commonwealth land	Section 5.3, Figure 5.4
A calculation in hectares of potential SLL habitat at Lawson South, including information about how many hectares of potential habitat is l kely to be directly and indirectly impacted by the proposed action	Section 5.5, Figure 5.5
A map of potential SLL habitat at Lawson South overlaid with the proposed development footprint (including various development options if relevant	Section 5.5, Figure 5.5
A discussion about conservation priorities and fragmentation of SLL habitat in North Canberra	Section 5.4
A discussion about SLL habitat that is proposed to be retained at Lawson South, including information on how the remaining SLL habitat is proposed to be managed to:	Section 5.5

• mitigate indirect impacts on SLL; and • maintain or potentially improve the quality of SLL habitat	
Natural Temperate Grassland of the Southern Tablelands (NSW and the ACT)	
A discussion about how Natural Temperate Grassland (NTG), that is proposed to be retained within an ecological buffer zone at Lawson South, would be protected and managed in the long term, including management measures proposed	Section 6.2, Figure 6.1
2. Impacts on Commonwealth land (Lawson North)	
Species and ecological communities on Commonwealth land, including (but not limited to): i. Golden sun moth (*Synemon plana*) ii. Striped legless lizard (*Delma impar)* iii. Perunga grasshopper (*Perunga ochracea*) iv. Ginninderra peppercress (*Lepidium ginninderrense*) v. Natural Temperate Grassland of the Southern Tablelands vi. Box – gum communities vii. Latham's snipe (*Gallinago hardwickii*)	Section 7.2.1, Figure 7.1
The ecological context of the whole Lawson area (i.e Lawson South and the adjoining Commonwealth land), including mapping that depicts current development zoning, where listed threatened species and ecological communities adjoin at the boundary between the two sites, and potential impacts on habitat connectivity	Section 7.2, Figure 7.1
Potential direct and indirect impacts on those species and communities (i.e not limited to EPBC protected matters), including a discussion of groundwater dependant species/ecosystems and potential impacts on hydrological processes	Section 7.2.2
The heritage values on Commonwealth land and potential indirect impacts on those heritage values	Section 7.3
How indirect impacts on the environment on Commonwealth land will be mitigated and managed in the long term, consistent with the requirements of the conditions of approval for EPBC 2008/4367, including measures to: i. manage and/or restrict public access to the Lawson North site ii. protect and monitor the quality of the NTG at the site iii. protect and monitor the GSM population iv. protect and monitor other species and ecological communities of significance at the site v. report on and review management of ecological values at the site vi. protect and manage the identified heritage values, including the Commonwealth Heritage values, of the former Royal Australian Naval Transmitting Station in accordance with the policies of the management plan ''*Belconnen Naval Transmitting Station, Lawson, HMP*", prepared for the Department of Defence by Godden Mackay Logon, May 2009.	Section 7.4
3. Offset package	
The additional information must provide a proposal to offset the direct and indirect impacts of the proposed action on	Chapter 8

listed threatened species and ecological communities and Commonwealth land. The offset package must detail measures to address the protection and management of relevant listed threatened species and ecological communities habitat at offset sites in the ACT, and may also include management measures to improve the ecological values of Commonwealth land at Lawson North.	

APPENDIX B

PERSONNEL INVOLVED IN THE PREPARATION OF THIS PRELIMINARY DOCUMENTATION

Name	Organisation	Position	Contribution
David Hogg	David Hogg Pty Ltd	Principal/ Director	Report preparation
Jane McIntosh	David Hogg Pty Ltd	Environmental Planner	Report and map preparation
Kristine Nash	David Hogg Pty Ltd	Environmental Planner	Map preparation
Dave Richardson	Land Development Agency	Director	Project Manager Review of report
Stacey Quayle	Land Development Agency	Snr Project Manager	Project Manager Review of report
Daniel Santosuosso	Land Development Agency	Project Officer – GIS	Preparation of base maps
Murray Evans	Conservation Research and Planning	Senior Wildlife Ecologist	Ecological advice and supply of regional biodiversity maps

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LAWSON INTERSECTION (ALLAWOONA STREET)

ECOLOGICAL ASSESSMENT

Jane McIntosh and David Hogg
2 September 2009

1. Introduction

This ecological assessment has been prepared for Cardno Young Pty Ltd to review potential ecological issues associated with the construction of the intersection into Lawson on Ginninderra Drive at Allawoona Street, opposite the University of Canberra.

A site inspection was undertaken on 24 August to:

- assess the ecological condition of the site;
- determine the extent and quality of native vegetation that is present at the site, as well as any other features of ecological significance; and
- identify whether the area contains any threatened plant or animal species, endangered ecological communities or provides suitable habitat for any threatened animal species that are listed under the ACT *Nature Conservation Act* (*NC* Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act* (*EPBC Act*).

The report assesses the area within the Ginninderra Drive road reserve for the purpose of identifying whether there is a requirement for submitting a referral for the development under the *EPBC Act* and whether the development would require an environmental impact statement under Schedule 4 of the *Planning and Development Act.*

2. General Site Description and Surrounding Environment

The proposed works involve the conversion of the existing T-junction of Ginninderra Drive/ Allawoona Street to a four-way intersection that will provide access to the future suburb of Lawson (see Figure 1). The works are confined within the Ginninderra Drive road reserve.

Lawson is located in the north-east part of Belconnen. It contains the Belconnen Naval Transmitting Station (BNTS) site, which is Commonwealth land managed by the Department of Defence in the north, and ACT Territory land, currently being planned for future urban development, in the south (see Figure 1). In recent years, Lawson has been the subject of several environmental and ecological studies. Some of these studies, such as the Lawson South Planning Study (Ref. 1) have been for the specific purpose of guiding the suburban development of Lawson, while other studies have been undertaken to assist in regional planning for the conservation of threatened species, their suitable habitats and endangered ecological communities.

Within the BNTS site, there is 120 hectares of Natural Temperate Grassland, listed as an endangered ecological community under the *EPBC Act,* in a relatively good condition (Ref. 2). The grassland community supports populations of listed threatened species such as the perunga grasshopper (*Perunga ochracea*), the golden sun moth (*Synemon plana*) and the Ginninderra peppercress (*Lepidium ginninderrense*). There has also been one recording of the striped legless lizard (*Delma impar*) in the western part of this grassland (Ref. 3).

In the area that is proposed for urban development, there is a mixture of vegetation communities including native and exotic pasture, peppermint – apple box woodland and secondary grassland associated with red stringybark – scribbly gum forest. The site also contains small patches of the listed endangered ecological community yellow box – red gum woodland and associated secondary grassland as well as two discrete patches of natural temperate grassland (Ref. 1). In 2007, the golden sun moth was recorded in varying densities across half of the site (Ref. 1).

Both of these areas are remote from the site of the proposed works and current study area. Construction of the intersection would take place within the Ginninderra Drive road reserve which has been subject to previous disturbance for the construction of the road and the installation of overhead powerlines. The study area is gently undulating and College Creek runs in a north-west direction through the site. The vegetation is described in detail below.

3. The Existing Environment

3.1 Vegetation

Prior to European settlement, the surrounding area is likely to have supported natural temperate grassland, yellow box – red gum grassy woodland vegetation, peppermint – apple box woodland and red stringybark – scribbly gum forest at the higher elevations (Refs. 1,3,4). Within the Ginninderra Drive road reserve, the vegetation was likely to have been yellow box – red gum woodland close to the drainage line, grading into peppermint – apple box woodland on the steeper slopes. The absence of remnant trees makes it difficult to confirm this, however.

Today, the site consists predominantly of introduced groundcover species and scattered planted trees and shrubs. The groundcover is dominated by exotic pasture species such as phalaris (*Phalaris aquatica*), cocksfoot (*Dactylis glomerata*) and tall fescue grass (*Festuca arundinacea*) with paspalum (*Paspalum dilatatum*) occurring

in the wetter areas of the site. There is a small amount of native *Poa* sp. scattered throughout the site and several small patches of native kangaroo grass (*Themeda australis*).

Mid-layer vegetation in the area that is proposed to be cleared is dominated by various wattle species including silver wattle (*Acacia dealbata*), black wattle (*A. mearnsii*), red-stemmed wattle (*A. rubida*) and Cootamundra wattle (*A. baileyana*). The wattles have been planted and are regenerating well. Native blackthorn (*Bursaria spinosa*) is present throughout the site and several bushes of the weed, firethorn (*Pyracantha* sp.), also occur.

Three medium-sized trees, a eucalypt and a pair of casuarinas, that are proposed for removal are located on the edge of Ginninderra Drive (see Figure 2). All trees appear to have been planted and are not indigenous to the site. The casuarinas are in poor health. Several deciduous saplings close to these casuarinas would also be removed.

The configuration of the intersection would influence the alignment of the road into Lawson immediately to the north. Figure 3 shows the approximate alignment of the proposed intersection and the future alignment of the road beyond the intersection works. The initial part of this proposed future road is also confined mainly within the road reserve and the vegetation within this area is consistent with the above description. The works may require the removal of one medium-aged broad-leaved peppermint (*Eucalyptus dives*), a small amount of native pasture and two very small patches of degraded native pasture. Native grasses include spear grass (*Austrostipa* sp.), redleg grass (*Bothriochola macra*) and kangaroo grass (*Themeda australis*) and native forbs include plantain (*Plantago* sp.), *Lomandra* sp. and sheep's burr (*Acaena ovina*). Weeds such as St John's wort (*Hypericum* perforatum) and serrated tussock (*Nassella trichotoma*) occur throughout these native patches decreasing the value of these areas. It is not expected that the future construction of the part of the road beyond the intersection project would result in any significant ecological impact but this is beyond the direct scope of the current project.

3.2 College Creek

College Creek begins as an open defined watercourse in the eastern part of the site and runs adjacent to Ginninderra Drive before running through the future suburb of Lawson in a north-west direction (see Figure 2). The creek receives water from Kaleen, the University of Canberra and other parts of Bruce, as well as from the south-east corner of the future suburb of Lawson.

The riparian corridor has limited ecological value in its current condition. The creek banks contain a mixture of introduced species such as phalaris, paspalum and cocksfoot, with a minor component of native *Poa* sp. tussocks occurring along the creek edge. Planted trees, not native to the site, line the edge of the creek bank and include oaks (*Quercus* sp.), casuarinas and eucalypts. The creek bed is dominated by native bulrush (*Typha* sp.) but contains scattered weeds throughout, including thistles, purple top (*Verbena bonariensis*), broadleaf dock (*Rumex* sp.) and non-native bedstraw (*Galium* sp.).

At the time of the site inspection, a large amount of rubbish was present in the creek.

3.3 Threatened Species and Endangered Ecological Communities

Within the study site, there are no threatened species, endangered ecological communities or suitable habitat known to support threatened animal species that are listed under the *EPBC Act* and/ or the *NC Act*.

The area has been completely modified and contains predominantly introduced grasses, weeds and planted trees. The golden sun moth prefers a grassland habitat consisting of wallaby (*Austrodanthonia)* and spear grasses. The area proposed for development is not suitable habitat for this species.

While there are endangered ecological communities within the suburb of Lawson close to the site, these would not be affected by the proposed works.

3.4 Habitat

The ecological features that could provide habitat for fauna species within the study area include the planted trees and the riparian corridor of College Creek.

The trees are young, do not contain any nesting hollows and lack a native understorey. They may provide short term shelter for common bird species that are within the area but their ecological value is low in comparison to the remnant woodland trees that occur north of the site.

College Creek can provide habitat to a variety of species including birds, reptiles, amphibians and invertebrates. While the creek is in a relatively degraded condition, species such as frogs, aquatic invertebrates and birds could utilise the site. At the time of the inspection, the common eastern froglet (*Crinia signifera)*, a common ACT frog species, was heard in the creek upstream of the proposed works.

4. Potential Impacts and Road Design Implications

4.1 General Ecological Impacts

The ecological impacts that are associated with the proposed works are minor when considering the degraded condition of the site and its current limited ecological value. The area appears to have been disturbed on previous occasions with the construction of Ginninderra Drive and the installation of overhead powerlines, and has since been revegetated with introduced grasses and planted with trees and shrubs.

There is very little native vegetation present at the site. The proposed development would require the removal of approximately 0.25 hectares of introduced groundcover that is dominated by pasture grasses and weeds. In the wetter parts of the site, small patches of kangaroo grass and *Poa* sp. persist amongst the introduced species but these grasses are heavily outnumbered by the non native species. There is a small patch of degraded native pasture north-east of the study area, just outside the limit of the works, that contains a mixture of native grasses such as

kangaroo, spear and redleg (see Figure 2). This area is not considered a natural grassland community due to the low component of native forbs.

The proposed road development would require the removal of a eucalypt and a pair of casuarinas. These trees have been planted and are not indigenous to the site. The lack of nesting hollows and the presence of exotic understorey limit their habitat potential.

The removal of this vegetation would have a minor ecological impact given its non-native condition, and the presence of native grassland and woodland communities to the north of the site.

4.3 Impact on College Creek

College Creek passes directly through the area of the proposed intersection and receives stormwater from the suburbs of Kaleen and Bruce and the future suburb of Lawson. It is proposed to install a concrete culvert underneath the new intersection to allow the creek to continue to flow through the site before releasing the captured stormwater into Lake Ginninderra.

Installation of the culvert would result in the disturbance of approximately 80 metres of the creek, and would require excavation of the creek bed and banks with the removal of native and exotic vegetation (see Figure 3). The creek bed contains a mixture of native bulrush and weeds and appears to be in a relatively poor ecological condition. The creek banks are dominated by introduced grasses, weeds and planted trees. Removal of a small amount of this vegetation would have no significant ecological impact.

For the duration of the works, water would be diverted around the site to allow the work to be undertaken in dry conditions. This diversion would be temporary and would not impact on the ecological value of the site which, in its present condition, is limited anyway. Appropriate sedimentation controls would be in place during the works to protect the quality of the water entering Lake Ginninderra and would be assisted by the dense in-stream vegetation downstream of the site that would capture and filter any sediment if necessary.

The proposed works would not result in any negative impacts on drainage throughout the site or on College Creek itself. While the installation of the culvert may result in some alterations to the stream flow, this is unlikely to affect the habitat value of the site for frogs, reptiles and invertebrates outside the immediate worksite. The works would not result in any changes to the alignment of the creek which has already been modified to install culverts to direct water underneath Baldwin Street and Ginninderra Drive (see Figure 2). With the development of Lawson South, the creek is to undergo further modification including upgrading works to manage the 1 in 100 year flows (Ref. 1).

In summary, there would be no ecological impacts on College Creek that is expected to result from these works.

5. Implications under the *Planning and Development Act*

There are two potential triggers of an ecological nature under Schedule 4, Part 4.3, of the *P&D Act* which could require the preparation of an environmental impact statement for the proposed road extension. These are:

- if the proposal is likely to adversely impact on the conservation status of a species or ecological community that is endangered, or a species that is vulnerable; or
- if the proposal involves the clearing of more than 0.5 ha of native vegetation.

Section 3.3 describes the existing environment in relation to threatened species and endangered ecological communities and concludes that the site contains no listed threatened species, communities or suitable habitat that could support threatened animal species within the site. The first trigger is therefore not relevant to the proposed works.

Section 3.1 and 4.1 describes the vegetation that is present at the site and discusses the condition of the site in terms of native and exotic vegetation. The proposed works would result in the removal of mainly introduced vegetation, however the installation of the concrete culvert would require the removal of approximately 800 square metres (0.08 ha) of native bulrush within the riparian corridor. The proposed works therefore do not involve the removal of more than 0.5 ha of native vegetation and will not require the preparation of an environmental impact statement.

6. Implications under the *Environment Protection and Biodiversity Conservation Act.*

Based on the location of the site and the known characteristics of the surrounding area, threatened species and ecological communities listed under the *EPBC Act* that have the potential to be affected indirectly are as follows:

- Natural Temperate Grassland of the Southern Tablelands (NSW and ACT)
- White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands
- Golden sun moth

None of these is present within the study area or is likely to be affected indirectly. The main ecological issue affecting the road design is the disturbance to College Creek and the resulting impact on aquatic vegetation and habitat. This impact has been assessed as being minimal given the current degraded condition of the creek.

There are no other ecological issues arising from the proposal and there are no matters of national environmental significance within or around the study area that would be affected by the proposed development. It is therefore considered that an *EPBC Act* referral is not warranted for the proposed development.

7. References

1. Maunsell Australia Pty Ltd and Purdon Associates Pty Ltd. *Lawson South Planning Study. Draft for public comment*. Report prepared for ACT Planning and Land Authority. April 2009, Canberra.

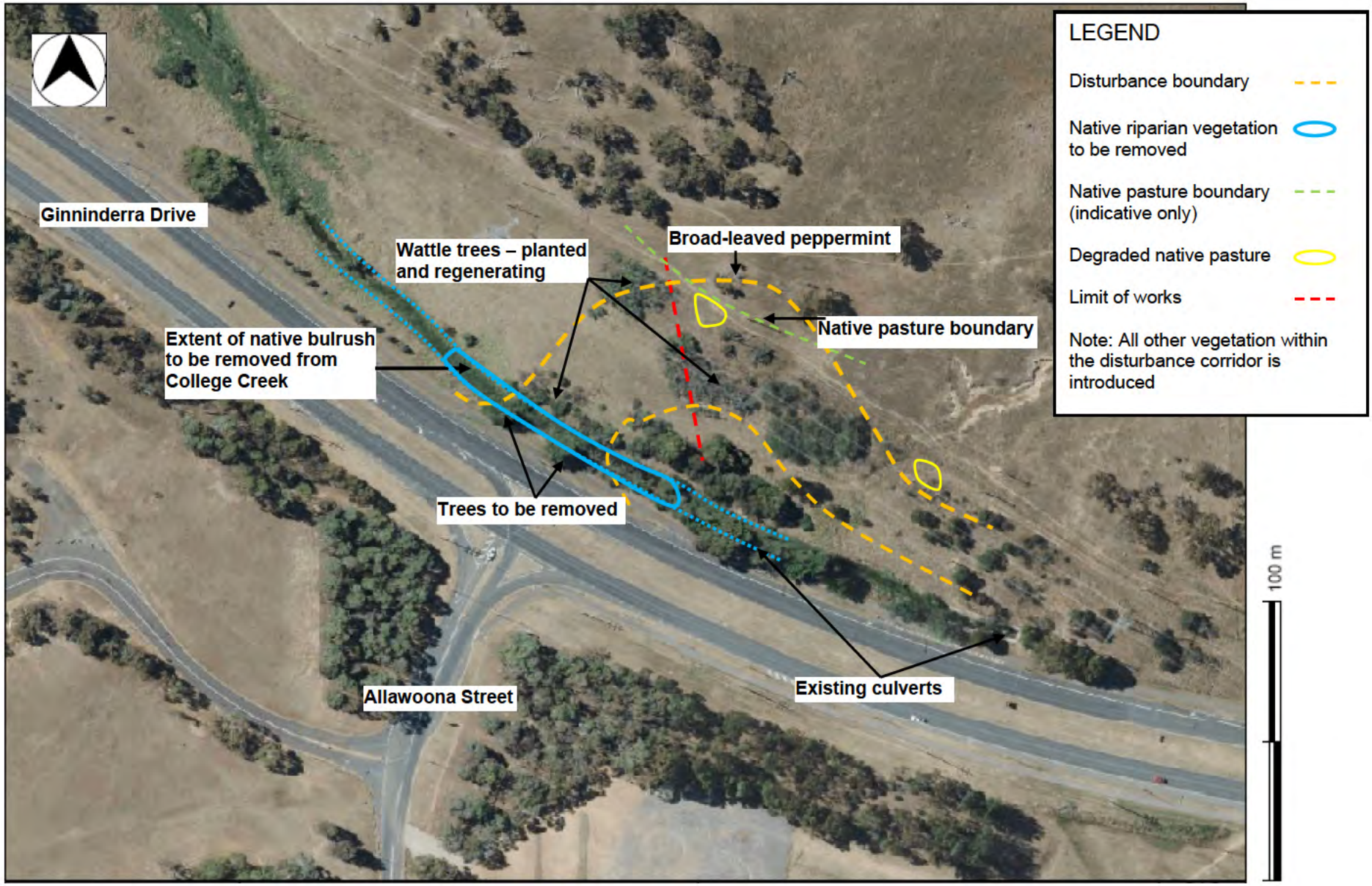
2. Cooper, M. *Report on ACT Lowland Native Grassland Investigation*. Report by the Commissioner for Sustainability and Environment for the ACT Government, March 2009, Canberra.

3. ACT Government. *A vision splendid of the grassy plains extended: ACT Lowland Native Grassland Conservation Strategy.* Action Plan No. 28, 2005. Arts, Heritage and Environment, Canberra.

4. ACT Government. *Woodlands for Wildlife: ACT Lowland Woodland Conservation Strategy.* Action Plan No. 27, 2004. Environment ACT, Canberra.

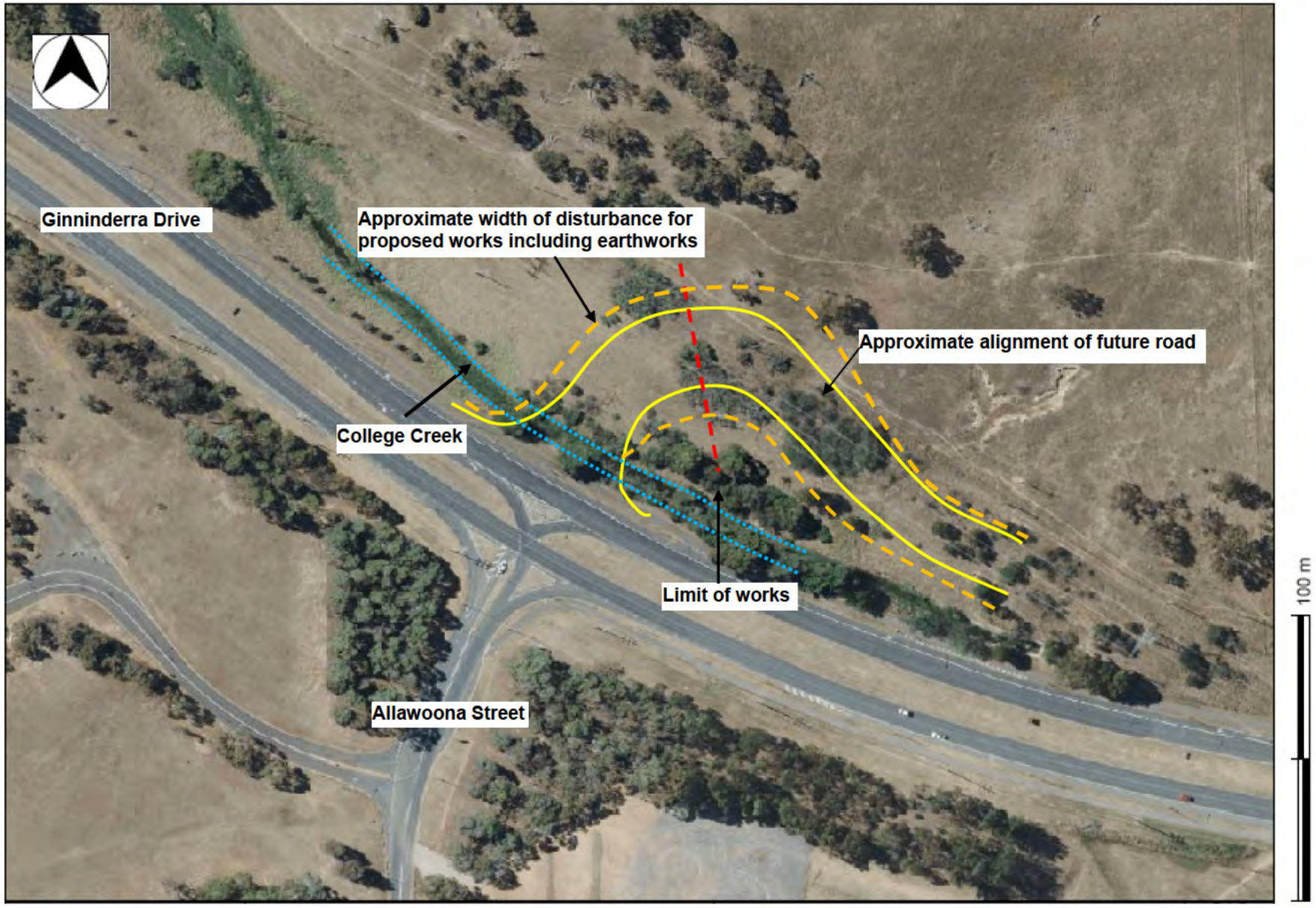
(Base map produced from ACTMAPi)

Figure 1. Location of proposed works



(Base map produced from ACTMAPi)

Figure 2. Existing environment



(Base map produced from ACTMAPi)

Figure 3. Existing intersection and approximate location of proposed works

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BLOCK 1 SECTION 4 AND PART BLOCK 2 SECTION 13, LAWSON ECOLOGICAL ASSESSMENT

Report to Land Development Agency
Kristine Nash

20 April 2010

1. Introduction

This report has been prepared on behalf of the Land Development Agency to describe the ecological characteristics of the study area and to identify any potential ecological constraints associated with this site. It is understood that Maribyrnong Avenue, located to the south of the study area, will be extended into Lawson (subject to an approvals process) and that the study area is being investigated for its potential to contain a construction works and/or materials storage area.

The study area is crescent shaped, being bounded by Baldwin Drive to the east and a former naval transmission station to the west. The site is gently sloping and generally open, with trees planted around the perimeter, in patches at the northern and southern ends of the site and with a small number planted along an access track located close and parallel to the western boundary. An overhead power line and supporting poles are located adjoining the access track.

It is probable that the area once contained woodland or natural temperate grassland prior to European settlement (Ref. 1). The ground surface over most of the area has since been substantially modified by tree planting and earthworks associated with the installation of the power line poles, including an access track, and by the construction of Baldwin Drive. The site has been described as substantially modified with an ecological constraint rating of low to very low (Ref. 2).

The ecological assessment of the area is based primarily on information collected during a site inspection on 20 April 2010.

2. Vegetation characteristics

In general, the groundcover vegetation located to the east of the access track is more highly modified than that on the western side. The area contains a patchy cover of mixed native and introduced grasses, primarily redleg (*Bothriochloa macra*)

on the small rises and paspalum (*Paspalum dilatatum*) in the depressions. Other native grasses occur in small patches and include wallaby grasses (*Austrodanthonia* spp.), spear grass (*Austrostipa* sp.), windmill grass (*Chloris truncata*), hairy panic (*Panicum effusum*) and a small amount of kangaroo grass (*Themeda australis*). There are a number of weeds, most notably plantain (*Plantago lanceolata*), sheep's burnett (*Sanguisorba minor*) and catsear (*Hypochaeris radicata*), with scattered regenerating briar rose (*Rosa rubiginosa*), cotoneaster (*Cotoneaster glaucophyllus*) and wattle (*Acacia dealbata*) shrubs, although, as the area appears to be constantly mown, the shrubs are low growing. A small amount of the native forb fuzz weed (*Vittadinia cuneata*) is scattered amongst the grasses.

The narrow strip of land to the west of the track is separated from the naval station by a fence. Several rows of introduced argyle apple gums (*E. cinerea*) and ash trees adjoin the road, with narrow strips of land dominated by native grasses located between the fence and the trees, and between the trees and access track. Although there are several patches containing weeds and introduced grasses and woody shrubs, the grassed areas are in a better native condition than those to the east. Kangaroo grass and mat-rush (*Lomandra* sp.) are common and widespread native species. Poa tussock (*Poa labillardieri*) and other native grasses and forbs are sparsely scattered beneath the trees.

A stand of planted trees, mostly red box (*E. polyanthemos*) and yellow box (*E. melliodora*), is located at the southern end of the site. The understorey is well mulched and contains scattered woody weeds such as cotoneaster interspersed with a sparse cover of native and introduced grasses. The ground surface has been disturbed for the installation of a power line running in an east-west direction, immediately south of the planted trees. There is a patch of native grasses closely located to the fence (west). Otherwise, the ground surface is bare of vegetation or is dominated by paspalum.

There is some landscaping at the northern end of the area, around an underpass providing pedestrian access underneath Baldwin Drive. Some of the grevillea shrubs have spread further from the area in which they were planted.

In general, the vegetation is highly modified and would not be considered a constraint on the proposed use of the area. The area to the east of the access track in particular has been highly modified and, although there are some native grasses, would not be considered native (Ref. 3).

3. Fauna Habitat

The quality of the grassy areas as habitat for native animal species is limited, although small birds probably utilise the shelter and food provided by the trees scattered across the site and located around the perimeter. The trees within the study area are too small to provide a major food source or nesting sites for native fauna.

The potential of the site to provide habitat for small animals such as reptiles is limited by the general lack of environmental attributes such as a significant amount of rock (embedded or surface), spider holes, cracks in the ground or fallen timber. The area

east of the access track appears to be regularly mown. The grasses have a tufted rather than the well developed tussocky structure that is known to support a wide range of native fauna.

4. Potential for Threatened Species and Ecological Communities

Threatened species are listed under both the ACT *Nature Conservation* Act (*NC Act*) and the Commonwealth *Environment Protection and Biodiversity Conservation Act* (*EPBC Act*), with some species appearing on one list and others appearing on both lists. Threatened species associated with grasslands and woodlands that may be relevant to the proposal are discussed below.

There are no records of any threatened species occurring within the study area (Refs. 1, 2) and the potential of the site to support such species has been substantially diminished through previous land uses. In addition, the area is highly modified and lacks the diversity of native forb (non-grass) species and a range of suitable habitat attributes that may indicate the presence of uncommon or threatened native plants, or threatened fauna associated with native grasslands or woodlands.

Striped legless lizard (*Delma impar*) habitat has been located in open grassland adjoining the western boundary of the study area (Ref. 1). That area contains tussocky grasses and appears to be dominated by a diverse cover of native grasses with some native forbs, although may include some introduced grasses and weeds. The site was observed from the fence. The striped legless lizard is known to occur in native temperate grassland, some secondary grasslands and in areas dominated by exotic tussock forming grasses. A tussock structure is considered to be an important habitat characteristic (Ref. 1). The groundcover within the study area appears regularly mown and the grass structure is consequently tufted rather than tussocky. Available evidence does not suggest that this lizard occurs within the study site.

The site does not contain a substantial amount of wallaby grasses, spear grasses or Chilean needlegrass (*Nassella neesiana*), plant species associated with the golden sun moth (*Synemon plana*, Ref. 4). Meandering transect surveys undertaken in summer 2007 did not observe the species within the study area (Ref. 2). The site lacks a tussocky grass structure that is considered an essential habitat requirement for the perunga grasshopper (*Perunga orchracea*, Ref. 1).

The study area does not meet criteria for consideration as any threatened ecological community (Refs 1, 5). The vegetation is not dominated by a cover of perennial tussock grasses, nor is there a diversity of native herbaceous plants. There are no remnant or regenerating woodland trees.

5. Access to proposed Maribyrnong Avenue extension

The area located in the southern corner of the study area is narrow and contains power lines and trees. There is a power line and associated poles and supporting structures (anchored wire) running east-to-west. Access for vehicles across this area, between the study area and the site of the proposed road extension, would be restricted.

6. Conclusions

The study area is substantially modified by past land uses and does not contain any features of high biodiversity value or that would constrain the proposed use of the site. There are no records of any threatened species occurring within the study area and the potential of the site to support such species has been substantially diminished through previous land uses.

Access to the area from the south is restricted by existing infrastructure, fences and trees.

References

1. ACT Government. *A vision splendid of the grassy plains extended: ACT Lowland Native Grassland Conservation Strategy.* Action Plan No. 28, 2005. Arts, Heritage and Environment, Canberra.

2. Eco Logical Australia Pty Ltd. *Environmental studies. Lawson Land Release* (Project no. 205-0011). Report prepared for ACT Planning and Land Authority by Eco Logical Australia Pty Ltd, May 2008.

3. Hogg, D.McC. *Guidelines for identification of native vegetation under the Planning and Development Act.* David Hogg Pty Ltd, July 2009.

4. Australian Government. *Background paper to EPBC Act Policy Statement 3.12 – Nationally threatened species and ecological communities. Significant impact guidelines for the critically endangered golden sun moth* (Synemon plana). Department of the Environment, Heritage, Water and the Arts, January 2009.

5. ACT Government. 2004. *Woodlands for Wildlife: ACT Lowland Woodland Conservation Strategy.* Action Plan No. 27. Environment ACT, Canberra.

ACT Government
Environment and Sustainable Development

Dave Richardson
Project Director
Land Development Agency
PO Box 158
Canberra City ACT 2604

Dear Mr Richardson

Draft EPBC Preliminary Documentation – Lawson South

Thank you for this opportunity to comment on a draft of the above document.

As you would be aware, in addition to approval under the *Environment Protection and Biodiversity Act 1999 (*EPBC*),* approval under section 45 the *Nature Conservation Act 1980* will be required for the proposal as it involves the destruction of a native animal with special protected status (golden sun moth). Ideally, the commitments provided in gaining EPBC approval, should also demonstrate that it is appropriate to grant the proposal approval under ACT's environmental legislation. Thus I welcome this chance to comment on draft EPBC documents and look forward to continued involvement.

I consider that the preliminary documentation describes well the important biodiversity features of the proposal area and provides good regional context. I commend the LDA for the thoroughness of survey undertaken. However, the preliminary documentation should consider native vegetation at Lawson as one habitat, widen the breadth of indirect impacts considered and provide more in depth consideration of biodiversity offsets. I suggest that these matters be addressed prior to lodging the preliminary documentation with the Commonwealth.

<u>The conservation value of Lawson as a whole is greater than that of the individual north and south components</u>
The preliminary documentation somewhat understates the values of the development area because it treats South Lawson and the Belconnen Naval Transmission Station (BNTS) as two separate sites, when in reality they are part of the one remnant patch. South Lawson is in a poorer condition than BNTS, but South Lawson does contain at least 20% of the golden sun moth habitat at Lawson and the moths that occur at South Lawson are part of one of the most important (in terms of size and viability) golden sun moth populations in the ACT Region. South Lawson, considered on its own, is probably one of the top twenty golden sun moth sites in the

ACT in terms of size of habitat and recorded moth numbers. An offset therefore, needs to demonstrate that there will be sufficient gains elsewhere.

The preliminary documentation should also consider the amount of striped legless lizard habitat within the BNTS, and whether the loss of potential habitat on South Lawson, currently regenerating from heavy grazing to a condition that provides a taller and continuous cover of tussock grasses, may affect the long term viability of this lizard at Lawson.

Comprehensive consideration of indirect impacts

The preliminary documentation requires a more comprehensive consideration of indirect impacts. In particular the documentation needs to consider that:

- significant environmental weeds, such as Chilean Needle Grass and Africa Lovegrass, will flourish as a result of the disturbance created in the building and functioning of a residential area. This will dramatically increase the seed flow and likely invasion of weed species into the BNTS;
- "ruderal" species (those that thrive in urban areas) such as the Indian Myna, house mouse, European wasp or Portuguese millipede will increase their local populations as a result of urban development which is likely to impact the plants and animals of the BNTS;
- locating 1400 dwellings next to and generally overlooking the BNTS will create a recreation pressure within the BNTS which will need to be managed. The current man-proof fence provides a certain level of protection from recreational pressures and dogs and cats but is unlikely to maintain its integrity in the long term unless it is conscientiously maintained to manage recreational pressures; and
- bushfire management is likely to be more onerous and potentially of greater impact than described in the preliminary documentation.

The offset package

As stated in the Commonwealth's draft policy statement, biodiversity offsets are compensatory measures that seek to **maintain or enhance** the matters under consideration. Thus the overall population of golden sun moths at Lawson should at least remain the same after the loss of the habitat and animals at South Lawson, through improved management at BNTS increasing the population there to at least match the loss. Habitat clearing usually results in a total loss of the biodiversity feature under consideration, while improved management usually can only hope to gain a proportional increase in an existing population. Thus, the precautionary approach, adopted across Australia, is to offset a larger area than that being cleared.

I suggest that you examine previous decisions made by the Commonwealth, in relation to offsets for golden sun moth, which are available on their web site. The minimum previously accepted by the Commonwealth for loss of known habitat appears to be an offset ratio of 3:1, but there are reasons for considering that the ratio required by the Commonwealth at Lawson would be higher than elsewhere. Firstly, it may be difficult to detail management actions, beyond those already implemented, that would be likely to lead to a significant increase in the current BNTS golden sun moth population. Secondly, I understand that the Commonwealth considers that the EPBC approval conditions that allow Defence to transfer the land to another party have already protected the site and imposed conservation management.

I, and possibly the Commonwealth, would contemplate the whole of BNTS as an offset if it can be shown that the offset actions are above standard conservation management and will enhance the golden sun moth, Natural Temperate Grassland and striped legless lizard habitat. This would require long term, dedicated and exemplary management.

The idea of paying money for future management into a trust fund is a good one, which I endorse. However, the $300,000 proposed seems to be out by at least a magnitude and would cover only standard weed and other general management for three years but not be sufficient to address special biodiversity measures, monitoring, planning, fire fuel management, security and maintenance of assets. It needs to be recognised that an offset needs to be managed as long as the development impact, which in this case is in perpetuity. Naturally, the ACT Government would manage the site for its conservation values in perpetuity once it is owned by the Territory and declared nature reserve. However, a higher degree of management attention and therefore cost will be required for at least the first ten years of managing the entire north Lawson site.

Yours sincerely

David Papps
Conservator of Flora and Fauna

Date

Conservation Planning and Research (CPR) response to Defence comments on

S211 exemption for South Lawson

[redacted] the following is the response to your request of 17 April 2012 for comment on concerns raised by the Department of Defence in relation to the South Lawson S211 exemption application.

The scope and depth of environmental study undertaken in the South Lawson area is not readily apparent in the documents provided by the proponent as part of the EPBC referral, which appears to be the extent of documents referenced by [redacted], Project Director, Property Disposals, Department of Defence. The arguments put by [redacted] are basically correct as far as they relate to the documents referenced but, as detailed below, do not reflect the extent of knowledge gained from all studies undertaken at South Lawson [redacted] comments and suggestions (italicised) are reproduced below together with the corresponding response from CPR.

[redacted]

[redacted]

Defence Comment 3. Surveys for Striped Legless Lizard were conducted and did not record any Striped Legless Lizards on the site. However it is noted that Striped Legless Lizards have been recorded at Belconnen Naval Transmission Station and the surveys for South Lawson were conducted in January (mid-summer) when the ideal time for surveying for this species is in spring.

- *The ACT Government may consider conducting targeted surveys for Striped Legless Lizard during the accepted monitoring season to improve confidence in the survey results.*

CPR Response 3. The stripped legless lizard survey undertaken by Ecological Australia was indeed undertaken at an unsuitable time of the year and was unlikely to yield any meaningful results. However, South Lawson has been appropriately surveyed for striped legless lizards by:

- ACT Government (CPR) mid November – Mid December 1991 – two pitfall trap arrays near Ginninderra Creek, 520 trap nights per pitfall trap array, no striped legless lizards recorded;
- HLA Envirosciences 22 November 2001 – 20 December 2001 – two pitfall trap arrays in stipa grassland central area of South Lawson, 560 trap nights per array, no striped legless lizards recorded;
- Biosis 27 November 2010 – 8 Jan 2011 5 pitfall trap arrays with 10 traps in each array (50 traps) distributed across South Lawson, 1400 trap nights in total, no striped legless lizards recorded; and
- Biosis 8 Jan 2011 to 27 January 2011, 200 tiles (50 tiles in 4 grids) checked 4 times over 3 weeks (total of 800 tile checks), no striped legless lizards recorded.

Given the number of surveys for striped legless lizards at South Lawson, this site is now one of the most surveyed locations in the ACT. CPR is of the opinion that further surveys for SLL are unlikely to provide information that differs from previous survey results.

[redacted]

URBAN SERVICES

environment ACT
PART OF THE ACT GOVERNMENT AND THE DEPARTMENT OF URBAN SERVICES

M I N U T E

SUBJECT: Targeted Survey for Striped Legless Lizard at Lawson

Virginia Ebsworth
Land and Property

c.c Maria Mangeruca
Conservator Liaison

I refer to the draft report circulated recently for comment. Please note it is dated 15 January 2002, which is the same date as the previous draft about which we have previously commented.

I have annotated the draft report and attached a copy for re-direction to the consultant.

I welcome the fact that the new draft includes some changes which were suggested in our comments on previous drafts. Unfortunately the new draft still does not adequately address other issues and it contains what appear to be significant errors and inconsistencies.

I consider that all that can now be safely concluded from the study is that:

1. a population of the Striped Legless Lizard, *Delma impar* has been found in an area of natural temperate grassland on Defence land; and

2. this is of sufficient interest as to warrant reference to Environment Australia for consideration under the *Environment Protection and Biodiversity Conservation Act 1999* (C'th); and

Recommendations

I recommend that:

1. the draft report not be accepted at this time;

2. the Consultant be asked to amend the report taking into account the comments provided by Wildlife Research and Monitoring; and

3. pending completion of a satisfactory report and in order to enable planning of the suburb of Lawson continue, Defence and Land and Property proceed on the basis of the two conclusions set out above and include an option which will protect an area of natural temperate grassland as part of the urban open space system.

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David Shorthouse
Manager
Wildlife Research and Monitoring 02/08/2018

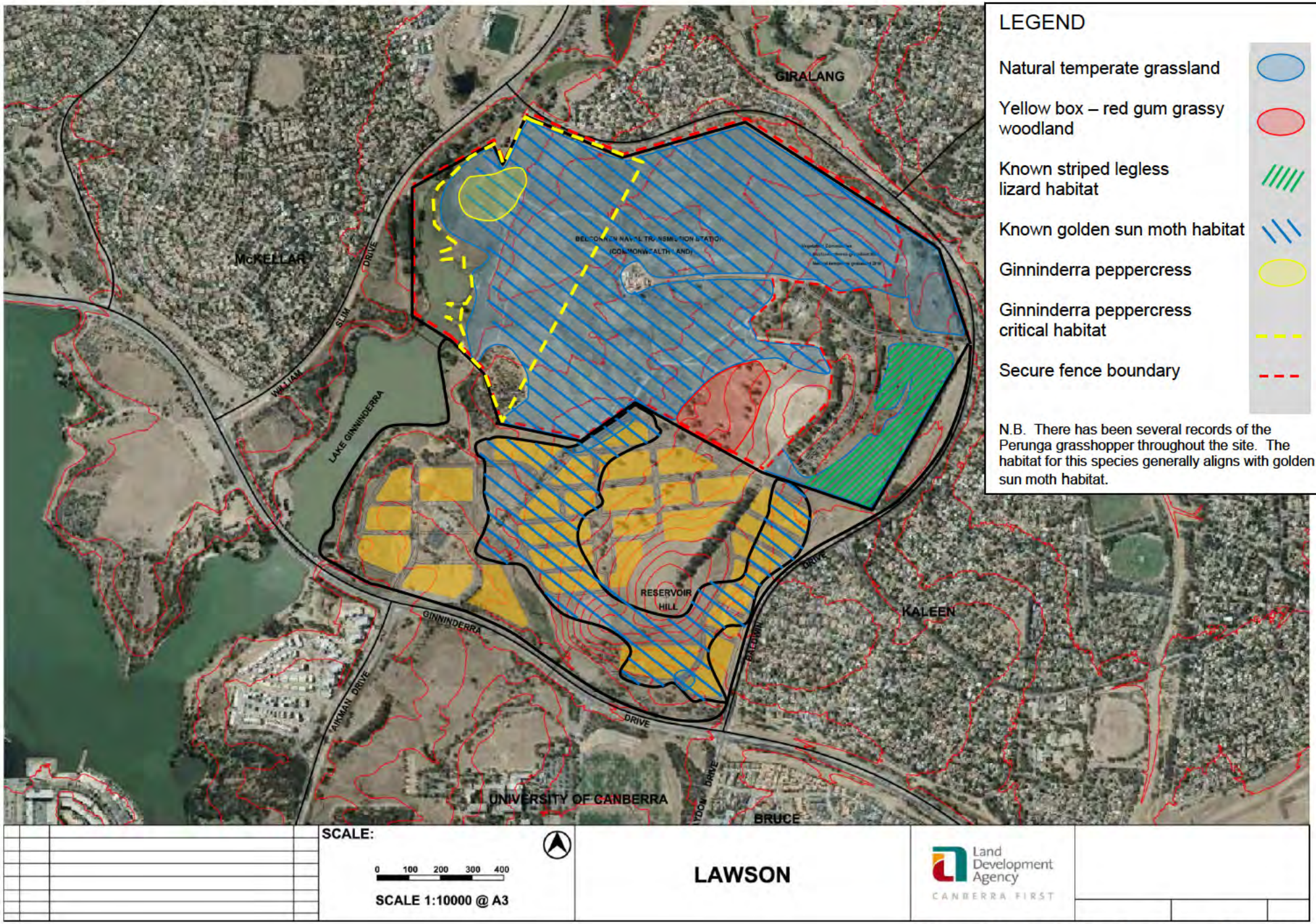

Figure 7.1 Ecological features of Lawson

environment ACT
ACT URBAN SERVICES

building our city
building our community
ACT Government

M I N U T E

SUBJECT: LAWSON INFRASTRUCTURE STAGE 1. PROJECT NO. 2002.0197

Helen McKeown
Conservator Liaison

The following issues are raised in relation to the final design report:

1. There is no indication in the report of a study having been undertaken to determine if the trees in the vicinity of the roadworks have any natural or cultural values. If any of the trees to be removed as part of the work program are natural, the implications of their removal need to be considered. If they are all planted, there are no ecological objections to their removal.

2. We question whether the assumption that there will be major roads entering Lawson at the indicated nodes is pre-empting the final design of the suburb, given there is no final decision on the area to be developed. However, there are no constraints to the entrances being where they are indicated.

3. The area from the entrance road to the Belconnen Naval Station to opposite the southern Maribyrnong Avenue intersection with Baldwin Drive contains remnant endangered natural temperate grassland community, and a population of the threatened Striped Legless Lizard. No works should in any way directly or indirectly impact this area. Such impacts include changes to drainage, spread of weeds, soil importation, or access (deliberate or incidental). The site compound identified at the entrance to the Belconnen Naval Station is inappropriately situated as it may impact the site. WRM staff will assist in locating a more appropriate site for the compound.

4. Tree and shrub planting in the vicinity of the native grassland on Baldwin Drive should reflect the natural vegetation structure and composition. It is recommended that only native tree and shrub species indigenous to the area be planted on either side of the road. Of the species identified for planting (drawing no. 221723-075) on the western side of Baldwin Drive, only Eucalyptus melliodora grown from seed collected within 10 km of the site should be planted, as sparsely spaced trees or as widely spaced clumps (reflecting an open woodland structure). Also on the western side of Baldwin Drive the grass seed mixture should not contain any tall fescue as this is an invasive species that may invade into the native grassland. A native grass mix in the near vicinity of the native grassland is preferable to an exotic mix.

Murray Evans
Wildlife Research and Monitoring
21/10/2004

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Lawson South Residential Estate – Estate Development Plan

Conservation Planning and Research Comments – 11 August 2011

Conservation Planning and Research (CPR), within ESDD, would like to reiterate and emphasise comments provided in earlier planning stages relating to:

1. Restoration actions on Reservoir Hill; and
2. Management of the fire asset protection zones.

As part of minimising indirect impacts of the development on golden sun moth habitat and native vegetation on Reservoir Hill, CPR strongly advises that a native vegetation enhancement/restoration plan be developed and funded for the Hill. The plan will need to include two key components:

- Initial and ongoing weed control, particularly of saffron thistle and exotic grass species, which should be reduced and maintained at levels where they are not dominant species on the Hill; and
- Planting and grassland management to increase the extent of native grass/native herb cover on the Hill.

Weed reduction and expansion of native grass cover will also have fire management benefits, as the fuel load of the native grasses will be less than that of weed dominated areas. The weeds are also more prone to drying off over summer and therefore pose a higher fire risk than the summer growing native grasses.

Weed management within the inner and outer asset protection zones will be crucial both to their optimum functioning and minimising impacts on the very high conservation values of the natural temperate grassland within the adjoining Belconnen Naval Transmission Station. Management within the outer asset protection zone will need to conform to the attached fire prescriptions (ATTACHMENT A). The implementation of these prescriptions will add to the complexity and cost of fire management. The Estate Development planning should ensure that sufficient funding and management capability is provided to minimise the impacts of the proposed fire protection measures.

Utilities

- **Proposed Underground Electricity**

The proposed services plan Sheet 2 of 5, Drawing No. 110003-SERV-02, page 211, indicates that underground electricity lines are proposed to be located in the open space corners at the two intersections of Road 26 and Road 23 in the northernmost corner of Lawson South.

Recommendation

It is recommended that these underground powerlines be relocated to follow the road reserves rather than cross diagonally through the open space grassland buffers.

- **Stormwater Management**

The Stormwater Master Plan Sheet 2 of 3, Drawing No. 110003-SWMP-02, Page 301 indicates that stormwater from Roads 26 and 23 and their associated development areas in the northernmost corner of Lawson South is proposed to drain directly onto the grasslands in Lawson North. The drawing also indicates that stormwater from node E01 in the north eastern corner of Lawson South is proposed to drain directly into Lawson North.

Recommendations

- It is recommended that stormwater from Roads 26 and 23 is not drained onto the Lawson North grasslands as the additional water will encourage the growth of undesirable species such as Paspalum. The stormwater from these roads and associated urban catchments should be redirected to drain into Lake Ginninderra.
- It is recommended that stormwater from Node E01 is redirected into the wetland east of node C05 to allow primary treatment and settlement before it is discharged into Lawson North. It is considered that the additional stormwater will not result in adverse impacts on the wet Themeda grassland in the eastern area of Lawson North.

ATTACHMENT A

Natural Temperate Grassland

Fuel and Fire Suppression Guidelines

(NB. In managing for good conservation outcomes, it is important to consider the ecosystem as a whole, including animals, plants, soil and soil biota, rather than thinking in terms of individual species. Disturbance to the composition or structure of the community can have impacts on the functioning of the system as a whole.)

Description

Natural Temperate Grassland is a declared **endangered ecological community** in the ACT. It is one of Australia's most threatened ecosystems. Natural Temperate Grassland is naturally treeless and comprises several native perennial grasses as well as many native herbs. The ecological community includes both flora and fauna and the interactions intrinsic in maintaining a functioning grassy ecosystem (ACT Government 2005). Several threatened plant and animal species may be found within the endangered ecological community.

Legal Status: Endangered (ACT); Endangered (Cwlth)

Appropriate inter-fire interval if known:

Activity	**Potential impact (H=high; M=moderate; L=low; C=conditional)**	**Guidelines**
Low intensity fire	MC	Any proposed burning of Natural Temperate Grassland should be within ecological thresholds and only conducted after first consulting Research and Planning. Any burning that does take place in Natural Temperate Grassland must be patchy and aimed at conserving the endangered community

		and threatened species. Appropriate timing and frequency are important considerations to allow for natural regeneration and to maintain habitat features.
High intensity fire	MC	Within higher end of thresholds, infrequent high intensity fires in appropriate season – minimise adverse effects on the endangered community and threatened species.
Slashing	MC	Any slashing that is undertaken will need to take into account the conservation of the endangered community and individual threatened species. There may be a requirement to remove slash. Appropriate timing and frequency are important considerations to allow for natural regeneration and maintain habitat features.
Physical and mechanical removal of naturally occurring shrubs, trees or ground layer plants	MC	Any shrub and understorey tree removal (e.g. on adjacent areas) must not impact on the grassland (e.g. vehicle damage). Removal of trees or shrubs may be acceptable in some cases in order to maintain grassland values.
Tree and limb removal	MC	No trees to be removed unless tree removal is for the purpose of maintaining grassland values.
Rock picking and surface reshaping	H	Physical disturbance to the soil will impact adversely on the grassland. Resulting in bare ground that can lead to weed invasion.
Herbicide application	MC	Avoid spraying except for species specific spot spraying and cut/paint methods for shrubs and trees.
Livestock grazing	MC	Any proposed grazing of Natural Temperate Grassland should only be conducted in agreement with Research and Planning. Appropriate timing and frequency are important considerations to allow for natural regeneration and maintain habitat features.
Use of fire suppression chemicals (high in phosphorus)	H	Use of retardant has been shown to have adverse effects on plants, particularly legumes. An increase in biomass is also associated with retardant use. The conditions created by retardant application are likely to favour weed species. These chemicals may also impact on fauna.
Use of fire fighting foam (surfactant)	H	Use of foam has been shown to have adverse effects on plants and may lead to plant damage and a decrease in species richness. These chemicals may also impact on fauna

Being driven over by vehicles or trampled by people	MC	Natural Temperate Grassland may be resilient to a small amount of vehicle activity at some sites, but this can be dependent on the site conditions (e.g. boggy) and also the particular species present.
Minor soil disturbance by hand tools (e.g. rakes)	H	Physical damage can kill or damage plants and an increase in exposed earth regularly leads to weed infestation which will threaten the endangered community.
Major soil disturbance (e.g. dozer/backhoe line)	H	Physical damage can kill or damage plants and an increase in exposed earth regularly leads to weed infestation which will threaten the endangered community.
Aerial water bombing (up to1500kg of water being dropped from a height of 100m).	H	The force of large amounts of water falling directly on populations may kill or damage plants and lead to soil loss.

Compiled by David Wong and Margaret Kitchin (advice from Sarah Sharp)

Research and Planning, PCL

Current at: June 2008

References

ACT Government 2005. *A Vision Splendid of the Grassy Plains Extended: ACT Lowland Native Grassland Conservation Strategy*. Action Plan No. 28. Arts Heritage and Environment, Canberra.

Golden Sun Moth *(Synemon plana*)

Fuel and Fire Suppression Guidelines

(NB. In managing for good conservation outcomes, it is important to consider the ecosystem as a whole, including animals, plants, soil and soil biota etc, rather than thinking in terms of individual species. Disturbance to the composition or structure of the community can have impacts on the functioning of the system as a whole.)

Description

The Golden Sun Moth *(Synemon plana)* is a medium sized moth. The wingspan of the male is about 34 mm, and larger than the female at about 31 mm. The upperside of the forewing of the male is dark brown with patterns of pale grey scales, and the hind wing is dark bronzy brown with dark brown patches. The underside of both wings of the male is mostly pale grey with dark brown spots. The upperside forewing of the female is very dark grey with patterns of pale grey scales and the hind wing is bright orange with black spots. The underside of both wings of the female is silky white with small black spots. In the ACT, the Golden Sun Moth usually occurs in natural temperate grassland dominated by Wallaby grass (*Danthonia spp.*) however, it has also recently been found in areas dominated by Chilean Needle Grass (*Nassella neesiana*) (Pers. comm. Mark Dunford).

Legal Status: Endangered (ACT); Critically Endangered (Cwlth)

Appropriate inter-fire interval if known:

Activities	**Potential impact (H=high; M=moderate; L=low; C=conditional)**	**Guidelines**
Low intensity fire	MC	Regular burning unless balanced by very positive advantages to the health of the grassland will be detrimental. Care should be taken with fire used as a management tool so that only a small proportion of any site is burnt at any one time. Preferable to avoid burning during the breeding season (Nov through to Feb). Seek advice from Research and Planning.
High intensity fire	H	High intensity fire may have deleterious effects on Golden Sun Moth habitat, moths and larvae.

Slashing	MC	Slashing may be employed in order to reduce competition between taller grass species and Wallaby Grass. The most effective time to slash is early to mid spring in order to minimise weed seed set. However, this may conflict with requirements to restrict grazing in order to allow seed set and seedling establishment of native species. May not be applicable to habitat in Chilean Needle Grass, as this may facilitate spread of this noxious weed. Slashing over large areas should not take place from November to January as males are flying at this time. Grass not to be slashed below a height of 10cm.
Physical and mechanical removal of naturally occurring shrubs, trees or ground layer plants	MC	Removal of shrubs or saplings may be appropriate in order to achieve conservation objectives. Seek further advice from Research and Planning.
Tree and limb removal	MC	Tree removal may be appropriate in order to meet conservation objectives. Seek further advice from Conservation Planning and Research.
Rock picking & surface reshaping	HC	These activities are likely to damage Golden Sun Moth habitat and may lead to an increase in weeds. Rock picking may be acceptable if it is for the purposes of managing a regularly slashed area. If rocks are to be removed to create areas for slashing, the impact will be minimised by restricting the area for rock removal to the slashing strip and the rocks that are removed should be scattered evenly (not stacked on top of each other or taken out of the area) within an adjacent strip of at least 20m wide.
Herbicide application	MC	Should be avoided except for species specific spot spraying of invasive grasses and cut/paint methods for invasive shrubs and trees.
Livestock grazing	MC	Grass to be grazed no lower than 20cm. Grazing may be employed in order to reduce competition between taller grass species and Wallaby Grass. The most effective time to graze in order to minimise weed seed set is early to mid spring. However, this may conflict with requirements to restrict grazing in order to allow seed set and seedling establishment of native species. Obtain advice from Research and Planning prior to changing any grazing regime. Grazing may not be applicable to habitat dominated by Chilean Needle Grass.

Use of fire suppression chemicals – fire retardant (high in phosphorous)	H	There have been few studies relating to the direct effects of foams and retardants on terrestrial fauna. Some adverse effects have been observed in some animals. As such, a precautionary approach should be taken and use avoided where possible. Changes to vegetation as a result of foam or retardant use may also impact on fauna.
Use of fire suppression agents – fire-fighting foam (wetting agent)	H	There have been few studies relating to the direct effects of foams and retardants on terrestrial fauna. Some adverse effects have been observed in some animals. As such, a precautionary approach should be taken and use avoided where possible. Changes to vegetation as a result of foam or retardant use may also impact on fauna.
Being driven over by vehicles or trampled by people	MC	Disturbance of habitat should not take place. Vehicles should stay on existing tracks. If It is absolutely necessary to leave existing tracks, soil compaction over large areas should be avoided by limiting vehicle movement to a single route. Avoid driving on wet or boggy areas.
Minor soil disturbance by hand tools (e.g. by rakes)	MC	Soil disturbance should not take place unless absolutely necessary as it has the potential to lead to an increase in weeds and degrade habitat.
Major soil disturbance (e.g. dozer/backhoe line)	H	This will impact adversely on the habitat, and so should be confined to existing tracks.
Aerial water bombing (up to 1500kg of water from 100m up)	MC	As long as this practice does not cause adverse impacts on the habitat such as damage to plants and soil loss.

Compiled by David Wong and Margaret Kitchin (advice from Murray Evans), Research and Planning, PCL, Current at: June 2008

References

ACT Government 2005. *A Vision Splendid of the Grassy Plains Extended: ACT Lowland Native Grassland Conservation Strategy.* Action Plan No. 28 (Arts Heritage and Environment, Canberra.

Perunga grasshopper *(Perunga ochracea*)

Fuel and Fire Suppression Guidelines

(NB. In managing for good conservation outcomes, it is important to consider the ecosystem as a whole, including animals, plants, soil and soil biota, rather than thinking in terms of individual species. Disturbance to the composition or structure of the community can have impacts on the functioning of the system as a whole.)

Description

The Perunga Grassland has mainly been found in grassland areas in the ACT, but also occurs in open woodland areas with a grassy understorey. Both sexes of the Perunga Grasshopper are short-winged and flightless. The species is distinctive in having the pronotum (the dorsal surface of the first thoracic segment) wrinkled and slightly extended caudally. In the Canberra region, the species is distinguished further by the appearance on the pronotum of a pale 'X' (D. Rentz pers. comm., in ACT Government, 2005), which is the most useful field identification characteristic. The wings are shorter than the length of the pronotum and possess many raised longitudinal veins. Adult females range in length from 26–35 mm and adult males from 15–20 mm. Males possess short, rounded furculae and simple, elongate cerci (the pair of appendages at the apex of the abdomen), each with a blunt, rounded tip which is slightly deflexed. Females bear very short, stout cerci and the dorsal ovipositor valves are strongly recurved. Adults are variable in colour, ranging from brown to grey and often with green. Colour can vary from year to year with a tendency toward grey-brown in dry years and greenish in wet years (R.C. Lewis pers. comm. In ACT Government 2005).

The Perunga Grasshopper requires some vertical structure in its habitat in the form of grass tussocks. Observations in the field show that these tussocks are important escape spaces and shelter spaces for the species, especially emerging nymphs.

Legal Status: Vulnerable (ACT)

Appropriate inter-fire interval if known:

Activity	**Potential impact** **(H=high; M=moderate; L=low; C=conditional)**	**Guidelines**
Low intensity fire	MC	The Perunga Grasshopper is likely to be vulnerable to burning and burning will decrease important grass tussock habitat. If burning does take place, it will be for the purpose of grassland conservation and must be undertaken in consultation with Research and Planning. Such burns will have to address

		the specific habitat requirements of the Perunga Grasshopper.
High intensity fire	H	The fire response of this species is unknown. High intensity fire is likely to have adverse effects on the endangered community. The Perunga Grasshopper is not very mobile so may be more susceptible to fire than other species.
Slashing	MC	Any slashing that is undertaken will need to take into account the conservation of the endangered community and individual threatened species. The Perunga Grasshopper relies on vertical tussock structure. Grass not to be slashed below a height of 10cm, however, slashing to a height of 10cm is permitted within the 30m wide slashing strips identified along the urban interface.
Physical and mechanical removal of naturally occurring shrubs, trees or ground layer plants	MC	Any shrub and understorey tree removal (e.g. on adjacent areas) must not impact on the grassland (e.g. vehicle damage). Shrub or sapling removal may be appropriate in some circumstance in order to meet grassland conservation objectives. Seek further advice from Research and Planning.
Tree and limb removal	N/A	Mature and hollow bearing trees (including dead standing trees) will not be removed. These trees provide valuable habitat for fauna.
Rock picking and surface reshaping	H	Physical disturbance to the soil will impact adversely on the grassland. Resulting bare ground can lead to weed invasion. Rock picking may be acceptable in some circumstances. If rocks are to be removed to create areas for slashing, the impact will be minimised by restricting the area for rock removal to the slashing strip and the rocks that are removed should be scattered evenly (not stacked on top of each other or taken out of the area) within an adjacent strip of at least 20m wide.
Herbicide application	MC	Except for species specific spot spraying of invasive grasses and cut/paint methods for invasive shrubs and trees.
Livestock grazing	MC	Any proposed grazing should only be conducted after first consulting Research and Planning. Do not graze grass tussock levels below 20 cm height, as it is important to maintain the tussock structure and inter-tussock spaces.
Use of fire suppression chemicals (high in phosphorus)	H	There have been few studies relating to the direct effects of foams and retardants on terrestrial fauna. Some adverse effects have been observed in some animals. As such, a precautionary approach should be taken and use avoided if possible. Changes to vegetation as a result of foam or retardant use may

		impact on fauna.
Use of fire fighting foam (surfactant)	H	There have been few studies relating to the direct effects of foams and retardants on terrestrial fauna. Some adverse effects have been observed in some animals. As such, a precautionary approach should be taken and use avoided if possible. Changes to vegetation as a result of foam or retardant use may impact on fauna.
Being driven over by vehicles or trampled by people	MC	Grassland may be resilient to a small amount of vehicle activity at some sites, but this can be dependent on the site conditions (e.g. boggy) and also the particular species present. Vehicle activity should be limited to existing access tracks. Seek advice from Research and Planning.
Minor soil disturbance by hand tools (e.g. rakes)	H	Physical damage can kill or damage plants and an increase in exposed earth regularly leads to weed infestation which will threaten grassland community.
Major soil disturbance (e.g. dozer/backhoe line)	H	Physical damage can kill or damage plants and an increase in exposed earth regularly leads to weed infestation which will threaten the grassland community.
Aerial water bombing (up to1500kg of water being dropped from a height of 100m).	MC	As long as this practice does not cause adverse impacts on the habitat such as damage to plants and soil loss.

Compiled by David Wong and Margaret Kitchin (advice from Murray Evans).

Research and Planning, PCL

Current at: June 2008

References

Act Government 2005. A Vision Splendid Of The Grassy Plains Extended. ACT Lowland Native Grassland Conservation Strategy. Action Plan No. 28. Environment ACT, Canberra.

Striped Legless Lizard *(Delma impar*)

Fuel and Fire Suppression Guidelines

(NB. In managing for good conservation outcomes, it is important to consider the ecosystem as a whole, including animals, plants, soil and soil biota, rather than thinking in terms of individual species. Disturbance to the composition or structure of the community can have impacts on the functioning of the system as a whole.)

Description

The Striped Legless Lizard is a reptile with a maximum total length of about 30cm. The species is variable in colour but is most commonly pale grey-brown above, with a series of dark brown or blackish stripes along the length of the body and tail, commencing at the neck (Cogger 2000 in ACT Government 2005). A large amount of variation exists between individuals in colour and intensity of the striping, and in some animals (particularly in the young), striping is indistinct or absent. The colour of the head is darker than the body, being dark brown to dark slate grey in adults and black in young individuals. The Striped Legless Lizard can usually be distinguished from the Inornate Legless Lizard *Delma inornata*, a closely related species that also occurs in the ACT region, by the presence of stripes. Legless lizards superficially resemble small snakes; however, they can be readily distinguished from snakes by having a visible ear opening, fleshy broad tongue, the presence of remnant hind limbs (which are reduced to two scaly flaps near the vent) and a tail that is longer than the body, which can be voluntarily shed.

The Striped Legless Lizard is found primarily in lowland native grasslands (Coulson 1990, Osborne *et al.* 1993, in ACT Government 2005). This habitat type occurs on flat or gently undulating plains (Coulson 1990, Hadden 1995, in ACT Government 2005), and is dominated by perennial, tussock-forming grasses such as Kangaroo Grass *Themeda triandra*, Speargrass *Stipa* spp. and Wallaby Grass *Danthonia* spp. (Coulson 1990, Hadden 1995, in ACT Government 2005). It is not limited to native grassland habitat and may also be found in exotic pasture (pers. comm. Mark Dunford 2008).

Legal Status: Vulnerable (ACT); Vulnerable (Cwlth)

Appropriate inter-fire interval if known:

Activity	**Potential impact (H=high; M=moderate; L=low; C=conditional)**	**Guidelines**
Low intensity fire	MC	Low intensity fire may impact this species, particularly if the fire is widespread. Slashing is preferred to burning for fuel reduction purposes. Seek advice from Research and Planning prior to burning this species' habitat. Burns should be avoided in late autumn as they will remove tussocks used for shelter in winter. Burns should also be

		avoided in winter as lizards are dormant at this time and those sheltering at the base of grass tussocks are likely to be killed. Burns should be patchy, with no more than 70% of the designated burn area actually burnt in a mosaic pattern.
High intensity fire	H	Specific fire response is unknown. High intensity fire may have deleterious effects on the species and its habitat.
Slashing	MC	The Striped Legless Lizard relies heavily on grass tussocks. Grass should not be slashed below 20 cm.
Physical and mechanical removal of naturally occurring shrubs, trees or ground layer plants	MC	Any shrub or understorey tree removal (e.g. on adjacent areas) must not impact on the grassland habitat (e.g. vehicle damage). Removal of shrubs and saplings from grassland habitat may be appropriate for the conservation of grassland habitat and species.
Tree and limb removal	MC	Tree removal may be appropriate in some circumstances in order to achieve grassland conservation objectives.
Rock picking & surface reshaping	H	These activities will lead to a loss of Striped Legless Lizard habitat and may lead to an increase in weeds and a reduction in native grass important to the lizard. Rock picking may be acceptable if it is for the purposes of managing a regularly slashed area. If rocks are to be removed to create areas for slashing, the impact will be minimised by restricting the area for rock removal to the slashing strip and the rocks that are removed should be scattered evenly (not stacked on top of each other or taken out of the area) within an adjacent strip of at least 20m wide. Any animals unearthed by the process will need to be relocated to habitat nearby (i.e. under similar type rocks) and the sighting should be reported to Research and Planning so that it can be recorded.
Herbicide application	MC	No broad scale spraying. Only species specific spot spraying of invasive grasses and cut/paint methods for invasive shrubs and trees.
Livestock grazing	MC	If grazing is employed, it will only be where it is in the interests of conserving the species and broader grassland conservation. Such actions will be at the discretion of Research and Planning. Do not graze grass tussock levels below 20 cm height, as it is important to maintain the tussock structure and inter-tussock spaces.
Use of fire suppression chemicals – fire retardant (high in phosphorous)	H	There have been few studies relating to the direct effects of foams and retardants on terrestrial fauna. Some adverse effects have been observed in some animals. As such, a precautionary approach should be taken and use avoided where possible. Changes to vegetation as a result of foam or retardant use may also impact on fauna.
Use of fire suppression agents – fire-fighting foam	H	There have been few studies relating to the direct effects of foams and retardants on terrestrial fauna. Some adverse effects have been observed in some animals. As such, a precautionary approach should be taken and use

(wetting agent)		avoided where possible. Changes to vegetation as a result of foam or retardant use may also impact on fauna.
Being driven over by vehicles or trampled by people	MC	Disturbance of habitat should not take place. Seek further advice from Research and Planning. Vehicles should stick to existing tracks. Avoid driving on grassland when wet or boggy.
Minor soil disturbance by hand tools (e.g. rakes)	MC	Soil disturbance should not take place unless absolutely necessary as it has the potential to lead to an increase in weeds and degrade habitat.
Major soil disturbance (e.g. dozer/backhoe line)	H	This will impact adversely on the habitat.
Aerial water bombing (up to 1500kg of water from 100m up)	MC	As long as this practice does not cause adverse impacts on the habitat such as damage to plants and soil loss.

Compiled by David Wong and Margaret Kitchin (advice from Murray Evans and Mark Dunford), Research and Planning, PCL

Current at: June 2008

References

ACT Government 2004. *Woodlands for Wildlife: ACT Lowland Woodland Conservation Strategy*. Action Plan No. 27. Environment ACT, Canberra.

Lawson South Residential Estate - Stage 1

Estate Development Plan Design Response Report, 2 December 2011

Conservation Planning and Research Comments – 10 January 2012

It is noted that some of our earlier comments have been adequately addressed. In particular that:

- a management plan will be developed for the areas of retained vegetation and golden sun moth habitat;
- weeds are being required to be controlled within the 100 m OAPZ;
- underground powerlines will not now be laid within the 30 m grassland buffer;
- that road 23 does not drain into the grassland to the north;
- that runoff from the development area draining to Node EO1 will be collected in separated retention/wetland structures prior to any flow into Lawson North

The Design Response Report states that the management of the OAPZ within the Lawson North Commonwealth land is the subject of a licence agreement between Department of Defence and the ACT. It is recommended that the 100 m OAPZ in Lawson North is managed in accordance with the TAMS Bushfire Operational Plan, Fuel and Fire Suppression Guidelines for Natural Temperate Grassland, golden sun moth, perunga grasshopper and striped legless lizard. The guidelines were provided as Attachment A to Conservation Planning and Research (previously Planning, Conservation and Land) comments August 2011.

Additional comments

It is also recommended that no disturbance occurs within the "reduced" buffer area that currently adjoins existing grassland to the north (but may eventually adjoin urban development), until all relevant approvals have been obtained and the final extent of the urban area within Lawson North is defined.

Conservation Planning and Research also agrees that drooping sheoak, would make a more valuable windbreak for wildlife than *Pinus radiata.*

ACT Government
Environment and Sustainable Development

MINUTE

SUBJECT: Comment on Draft Lawson EPBC Preliminary Documentation

To: David Papps, Conservator of Flora and Fauna

From: Sharon Lane, Manager Conservation Planning and Research

Date: 20 May 2011

Purpose

To provided LDA with requested comments from the Conservator on preliminary documentation required for EPBC approval.

Background

Lawson South lies to the north of Canberra University and adjoins the Belconnen Naval Transmission Station (BNTS) which is Commonwealth land. It is proposed that 1400 dwellings will be built on the 100 hectare area, with about half of the land being open space. The BNTS occupies about 120 ha.

The residential development was referred to the Department of Sustainability, Environment, Water, Population and Communities under the *Environment Protection and Biodiversity Conservation Act* (*EPBC Act*) on 24 June 2010. The Commonwealth determined that the proposal will require approval under the *Act* because of the potential for the development to have a significant impact on listed species (golden sun moth, stripped legless lizard), endangered natural temperate grassland and Commonwealth land. The Commonwealth decided that impact assessment could be via preliminary determination and requested specific information within this documentation.

Comment on draft preliminary documentation has been requested by the LAPS prior to referral to the Commonwealth.

Approval under section 45 the *Nature Conservation Act 1980* will be required for the proposal as it involves the destruction of a native animal with special protected status (golden sun moth).

Issues

Accuracy of information

The data presented in the report on the extent of golden sun moth habitat (32 ha known + 16 ha potential) and the striped legless lizard (not recorded on site after three surveys, but 65 ha potential habitat) is accurate. The regional data presented in the report was largely supplied by Conservation Planning and Research and is reasonably up to date (there have been a few more recent recorded locations of the golden sun moth).

The vegetation of the site is also described reasonably accurately, with two small patches of natural temperate grassland being present. Not mentioned in the report, is that about 3-5ha of the site supports Box-Gum woodland. In summer 2011, 10 native herbs were recorded in a 20 square metre area, including several species considered to be important by the Commonwealth. To qualify as part of the EPBC listed community 12 native herbs (including one important species) has to be located. It is likely with stock continuing to be excluded from the area and in a spring survey that the patch would meet the Commonwealth criteria, but did not at the time of survey done for the report.

Understating of the significance of South Lawson

The preliminary report treats the South Lawson and the BNTS as two separate sites, when in reality they are part of the one patch. South Lawson is in a poorer condition than BNTS, but South Lawson does contain at least 20% of the Golden Sun Moth habitat at Lawson and the moths that occur at South Lawson are part of one of the most important (if not the most important in terms of size and viability) golden sun moth populations in the ACT Region. However, it is probable that that loss of the 20% of habitat at South Lawson will not significantly diminish the viability of the Lawson moth population.

The report also down plays the importance of the South Lawson site stating that as it is mainly secondary rather than natural grassland it is not natural or prime habitat for the moth. However, the moth is known from existing woodland sites and grassland dominated by *Themeda* seems to provide marginal habitat. Even if South Lawson is taken in isolation there are few areas (less than 20 of the known ACT sites) that provide habitat of over 10 hectares and in which over 50 moths have been recorded at a particular time.

The striped legless lizard only seems to occupy a small portion of the BNTS (around 30 ha), that in which *Themeda* is common. Generally the lizard is only known from grassland patches greater than 100 ha, so the viability of this lizard population is uncertain. Striped legless lizard is not strictly dependent on *Themeda* grassland but does prefer areas with dense continuous tussock structure, the level of grazing on South Lawson has in the past removed this structure, but if the residential

development was not being built, it is probable that favourable habitat would regenerate on South Lawson, continuous with that in the BNTS, which may improve the long term viability of this species at Lawson. It is also probably true that past over grazing on the BNTS may have reduced the habitat of this species and that potential habitat within the BNTS could be enhanced.

Indirect impacts

The preliminary report significantly understates likely indirect impacts on the BNTS:

- it only considers garden plantings as possible future environmental weeds, when the disturbance created in the building and functioning of a residential area will more than likely result in a proliferation of significant weeds such as Chilean Needle Grass and Africa Lovegrass and dramatically increase the seed flow of weed species into the BNTS;
- it does not consider the likely increase in "ruderal" species (those that thrive in urban areas) such as the Indian Myna, House Mouse, European wasp or Portuguese Millipede and the impact that increased local populations of these species may have on the plants and animals of the BNTS;
- it does not consider potential recreational impacts; and
- bushfire management is likely to be more onerous and potentially of greater impact than described.

Offset package

The preliminary report proposes that 40 ha of BNTS and a $300,000 payment into a trust for management will provide the offset for the loss of 32 ha of known habitat and 16 ha of potential habitat of Golden Sun moth. This would also meet the requirement to offset the loss of 2 ha of natural temperate grassland. No mention is made of an offset for loss of potential striped legless lizard habitat.

The preliminary documentation shows a fundamental misunderstanding of the nature of a biodiversity offset and a disregard for past Commonwealth decisions requiring offsets for loss of Golden Sun Moth habitat.

The Commonwealth has consistently stated that the EPBC approval conditions that allow Defence transfer of the land to another party, have already protected the site and imposed conservation management. They would prefer an additional land offset at another site, which is consistently an approval condition for clearing golden sun moth habitat elsewhere. The Commonwealth may contemplate BNTS as an offset if it can be shown that the offset actions are above standard conservation management and will enhance the golden sun moth, Natural Temperate Grassland and striped legless lizard habitat. It may be difficult to enhance the golden sun moth habitat

beyond that currently present, while even where the Commonwealth is accrediting increased security of land through reservation, they have required at least a 3:1 offset ratio between the size of an offset and the area of golden sun moth habitat being cleared. Forty eight hectares of known and potential GSM habitat is being lost at South Lawson. Nevertheless, grazing management at the site is above that required in most conservation reserves and expensive kangaroo culling has been required, so a case may be able to be made, but funding would need to provide for dedicated and exemplary management. The $300,000 proposed is a magnitude below that which would be required for such management.

Recommendations

That you:

1. Note the above information; and
2. sign the attached letter

Name: Sharon Lane
Title: Manager
Branch: Conservation Planning and Research
Division

Date

Action Officer: Michael Mulvaney
Branch: Conservation Planning and Research

Extension: 59964

LEGEND:

Trapping sites

0 500

Metres

Scale : 1 : 10 000

HLA-Envirosciences Pty Limited
18 Warabrook Boulevarde
Warabrook, NSW
(02) 4968-0044

LOCATION PLAN FOR TRAPPING AREAS ARRAYS

FIGURE **2**

DRAWN	PROJECT - TASK NUMBER	APPROVED	DATE
LF	D0186		February 2002

Draft Variation to the Territory Plan No. 299
Lawson South Structure Plan and Concept Plan
Research and Planning comments 31 August 2009

Research and Planning has provided advice to ACTPLA on previous planning studies for Lawson south. We note that the Draft Variation to the Territory Plan No. 299 has partially addressed one of the key issues raised in our previous submissions, that is, provision of a buffer zone along the entire northern boundary of Lawson south if the Commonwealth land on the former Belconnen Naval Transmission Station (BNTS) is not developed. However, the Draft Variation still pre-empts that residential development will occur within the eastern portion of the former BNTS by zoning the area as residential land.

Variation to the Territory Plan Map, figure 3.
The Draft Territory Plan Map indicates that RZ4 – Residential (Medium Density) development is proposed within Lawson south along the north eastern boundary adjacent to the Belconnen Naval Transmitting Station (BNTS). The eastern portion of the BNTS contains Natural Temperate Grassland (NTG), an endangered ecological community, and one not well represented in the ACT. The grasslands are rated as Category 1 Conservation Class (the highest level possible) in the ACT Lowland Native Grassland Conservation Strategy 2005, prepared by the Conservator of Flora and Fauna under the *Nature Conservation Act 1980*. To be rated Category 1, Core Conservation, it is necessary to meet the following criteria:

- high botanical significance rating (BSR of 1 or 2), but may contain or adjoin areas of lower rating; or
- key threatened species habitat; or
- large sites (more than 100 ha) with a BSR of 3.

Nineteen sites in the ACT meet the criteria and these sites represent the core group of areas needed to ensure conservation of the best quality natural temperate grassland and the major habitats for grassland threatened species. The former BNTS site forms the core conservation area for Striped Legless Lizard, Golden Sun Moth and Perunga Grasshopper. The Striped Legless Lizard (*Delma impar*) has been found in the NTG in the eastern portion of BNTS. Any development on this portion of the BNTS would require referral to the Commonwealth under the EPBC Act.

Recommendations:

- It is recommended that the RZ4 Residential land use zone be removed from the Territory Plan Map in the north eastern corner of the Lawson south site and replaced with a 30 metre wide (minimum) buffer zone of NUZ3 – Hills Ridges and Buffer Zone.

Lawson South Concept Plan
Part A – Precinct Controls

Map1.2: Concept Plan and Map 1.3: Housing Precincts
These maps show proposed medium density residential development in the north eastern portion of the Lawson south site and potential future road connections to the former BNTS site. It is not certain that the land that will be developed and is more likely that it will not be developed given the ecological constraints.

Recommendations:

- It is recommended that the concept plans be changed and that the residential development on the north east boundary be replaced with a grassland buffer zone (minimum 30 metres wide).
- It is recommended that all references to potential future connections to possible future development in the BNTS site be deleted.

Element 2
At the end of the Rules and Criteria tables, a Note has been inserted which states

> "Twenty-four (24) hour cat containment measures are included for all individual residential blocks in Lawson south that border the high value conservation area in the Commonwealth land, in accordance with the requirements of TaMS".

Cat containment is supported, however, to be effective it would need to be applied across the whole suburb. Cats have been known to range for more than one kilometre and their presence in Lawson south could pose a significant threat to the endangered grassland reptile species and Golden Sun Moths in BNTS.

Recommendation:

- It is recommended that cat containment be made a condition for the entire Lawson south development.

Element 4
The north eastern corner of Lawson south is in a separate drainage catchment from the rest of the site. The area drains towards the north east into the BNTS site which contains nationally threatened NTG and the Striped Legless Lizard. Runoff from urban development will have an adverse impact on the NTG and habitat of the Striped Legless Lizard. We note that the Element 4, Rule R40 indicates that a water quality control pond should be provided in the north-eastern corner of Lawson South.

Recommendation:

- That the water quality control pond is located within the grassland buffer zone that should be provided along the north eastern boundary of Lawson south.

South Lawson Planning Study
Research and Planning comments 20 May 2009

Research and Planning would like to take this opportunity to reiterate previous advice to ACTPLA that does not appear to be adequately addressed in the South Lawson Planning Study.

Concept Plan (Figure 25)- Buffer Zone along the boundary to the Belconnen Naval Transmission Station.

We are pleased to note that a 30 metre wide buffer zone has been located inside the ACT land adjacent to Defence land to protect the Golden Sun Moth and Natural Temperate Grassland on the Defence land. It would be preferable that this buffer zone be increased to incorporate the small pocket of Natural Temperate Grassland located to the north of the site in the vicinity of the Stock Route.

The Concept Plan pre-emts that residential development will occur within the eastern portion of the Defence land by providing future access points from South Lawson to the north. The Concept Plan indicates that residential development will occur in South Lawson right up to this northern boundary.

The eastern portion of the BNTS contains Wet Themeda, Natural Temperate Grassland, an endangered ecological community, and one not well represented in the ACT. The grasslands are rated as Category 1 Conservation Class (the highest level possible) and are contiguous with similar vegetation in the BNTS that forms the core conservation area for Striped Legless Lizard, Golden Sun Moth and Perunga Grasshopper.

The area also contains Striped Legless Lizard (*Delma impar*) habitat and the species has been found here. Any proposed development on this portion of the BNTS would require referral to the Commonwealth under the EPBC Act. It is not certain that development on Defence land will proceed.

It is recommended that the 30m wide grassed buffer zone should extend for the entire length of the boundary with the Defence land to the north, including along the boundary in the north eastern corner.

The recommended buffer zone in the north eastern corner should also contain a wetland as shown on Figure 23. The construction of a wetland in this location would ensure protection of an endangered ecological community from urban runoff.

It is recommended that the access road from Baldwin Drive, which forms a 4-way intersection with Maribyrnong Avenue, forms an edge road along the northern boundary of the South Lawson development.

The 30 m wide buffer zone should not contain the urban edge road. It may contain a recreation trail for pedestrians and cyclists. We support the proposal to prepare an environmental management plan for the buffer zone.

Planning Provisions for Precinct Code (Section 5.4)
It is recommended that reference to the provision of an access connection from the northern part of Lawson South to connect with potential future development on Defence land be deleted.

All references to the 30m wide grasslands buffer zone adjacent to the BNTS site should be adjusted to refer to a buffer zone along the **entire** northern boundary of South Lawson.

EPBC Referral
The Lawson site supports endangered ecological communities and threatened species. Research and Planning believes that the consultant report has overlooked an area of the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland EEC in the central northern portion of the development area. This site meets the following requirements for classification of the EEC; Yellow Box is at least one of the most common overstorey species, the patch has a predominantly native understorey, the patch is more than 2 hectares in size and there is natural regeneration of the dominant Eucalypt (refer to: EPBC Act Policy Statement for White Box - Yellow Box -Blakely's Red Gum grassy woodlands and derived grasslands). For this reason we reiterate the need for the development to be referred to the Commonwealth Department of Environment, Water, Heritage and Arts.

Ecolcogical Values of the South-eastern corner of BNTS

Legend

Known Striped Legless Lizard Habitat (Delma_impar)

Natural Temperate Grassland Conservation Category

1

2

3

N

0 125 250 500 Meters

DEPARTMENT OF
THE ENVIRONMENT,
CLIMATE CHANGE,
ENERGY AND WATER

Chief Planning Executive
ACT Planning and Land Authority
Dame Pattie Menzies Building
DICKSON ACT 2602

In accordance with Section 61(b) of the *Planning and Development Act 2007*, I advise that I have examined Draft Variation to the Territory Plan No. 299 – Lawson South Structure Plan and Concept Plan, and provide the following comments:

The proposed development of south Lawson is adjacent to the Commonwealth owned former Belconnen Naval Transmission Station (BNTS) that contains Natural Temperate Grassland (NTG), an endangered ecological community, and one not well represented in the ACT. The grasslands are rated as Category 1 Conservation Class (the highest level possible) in the ACT Lowland Native Grassland Conservation Strategy 2005. To be rated Category 1, Core Conservation, it is necessary to meet the following criteria:

- high botanical significance rating (BSR of 1 or 2), but may contain or adjoin areas of lower rating; or
- key threatened species habitat; or
- large sites (more than 100 ha) with a BSR of 3.

Nineteen sites in the ACT meet the criteria and these sites represent the core group of areas needed to ensure conservation of the best quality natural temperate grassland and the major habitats for grassland threatened species. The former BNTS site forms the core conservation area for Striped Legless Lizard, Golden Sun Moth and Perunga Grasshopper and must be protected from impacts of development.

I note the draft Variation to the Territory Plan and Concept Plan allow for the provision of a grassed buffer zone along the boundary with the BNTS for the majority of the interface and states that the buffer will be extended to the entire northern boundary of Lawson south if the Commonwealth land is not developed. However, the Draft Territory Plan Map indicates that RZ4 – Residential (Medium Density) development is proposed within Lawson south along the north eastern boundary adjacent to the BNTS pre-empting that residential development will occur within the eastern portion of the BNTS. The Striped Legless Lizard (*Delma impar*), a nationally threatened species, has been found in the NTG in this eastern portion of BNTS and any development on this portion of the BNTS would require referral to the Commonwealth under the EPBC Act.

To ensure protection of the grasslands it is recommended that the concept plans and land use zoning on the draft variation be changed and that the residential development on the north east boundary be replaced with a grassland buffer zone (minimum 30 metres wide) with a Hills Ridges and Buffer land use. It is also recommended that all references to potential future connections to possible future development in the BNTS site be deleted.

The rules and criteria provided in the Concept Plan, that will form the Precinct Code for future development, needs to reflect the requirement for a minimum of 30 meter wide grassland buffer for the entire boundary with the Commonwealth land and this must be a mandatory requirement.

There must also be a requirement that no services are to traverse the adjoining grasslands as any trenching will have an unacceptable impact on the grasslands.

Cat containment is supported, however, to be effective it would need to be applied across the whole suburb. Cats have been known to range for more than one kilometre and their presence in Lawson south could pose a significant threat to the endangered grassland reptile species and Golden Sun Moths in BNTS.

The north eastern corner of Lawson south is in a separate drainage catchment from the rest of the site. The area drains towards the north east into the BNTS site which contains nationally threatened NTG and the Striped Legless Lizard. Runoff from urban development will have an adverse impact on the NTG and habitat of the Striped Legless Lizard. It is noted that Element 4, Rule R40 indicates that a water quality control pond should be provided in the north-eastern corner of Lawson South. It is recommended that the water quality control pond is located within the grassland buffer zone that should be provided along the north eastern boundary of Lawson south.

Please contact Helen McKeown, Conservator Liaison, on 62072247 if further information is required.

Robert Neil
A/g Conservator of Flora and Fauna

September 2009

BIOSIS
RESEARCH

Lawson South

Threatened Reptile Survey Report

A report prepared for the ACT Land Development Agency

March 2011

Natural & Cultural Heritage Consultants 16/2 Yallourn Street, Fyshwick 2609

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This document may be cited as: Biosis Research (2011). *Lawson South – Threatened Reptile Survey Report*. Unpublished report to the ACT Land Development Agency.

DOCUMENT CONTROL SHEET

PROJECT	Lawson South - Threatened Reptile Survey
BIOSIS PROJECT NO	12338
REPORT FOR	ACT Land Development Agency
REPORT TITLE:	Lawson South - Threatened Reptile Survey Report
AUTHOR(S):	Robert Speirs

REVISION	***PREPARED***	***INTERNAL REVIEW***	***EXTERNAL REVIEW***	***AMENDED***
Draft	Robert Speirs	Ian Smales	Meagan Cousins	09-03-2011
Final	Robert Speirs	Ian Smales		

ACKNOWLEDGEMENTS

Biosis Research would like to thank Dr Murray Evans and Greg Baines (Senior Ecologists, ACT Government, Dept of Territory and Municipal Services) for their advice and support during the conduct of this study.

Biosis Research would also like to acknowledge the assistance of the staff of the ACT Government Land Development Agency, including Meagan Cousins (Project Manager), Adam Nugent and Steven Abbott (Estate Management Officers).

The following Biosis Research staff are thanked for their assistance and contribution during the conduct of field surveys and preparation of this report.

- Ashleigh Pritchard (GIS Operator)
- Samantha Vertucci (Research Assistant)
- Layla Watson (Research Assistant)
- Josephine Dessmann (Field Zoologist)
- Adam Birnbaum (Field Ecologist)
- Kylie Reed (Zoologist)
- Ian Smales (Senior Consultant Zoologist)

ABBREVIATIONS AND COMMON TERMS

ACT	Australian Capital Territory
BNTS	Belconnen Naval Transmission Station
BOM	Commonwealth Government Bureau of Meteorology
Commonwealth	Government of the Commonwealth of Australia
CPR	Conservation, Planning and Research unit of the ACT Government Department of Territory and Municipal Services
DECCW	NSW Government Department of Environment, Climate Change and Water
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
HMAS	Her Majesty's Australian Service
LDA	ACT Government Land Development Agency
MGA	Map Grid of Australia
MNES	Matters of National Environmental Significance
NC Act	*Nature Conservation Act 1980* (ACT)
NSW	New South Wales
pers. comm.	Resulting from personal communications
pers. obs.	Resulting from personal observation/s
Secondary Grassland	Native grassland that exists post clearing of temperate woodland
SEWPAC	Commonwealth Department Sustainability, Environment, Water, Population and Communities
SLL Survey Guidelines	*Survey Guidelines for Striped Legless Lizard* (ACT Government)
sp.	Species (singular)
spp.	Species (plural)
ssp.	Subspecies
Study Area	The area encompassed by the Lawson South land release
TAMS	ACT Government Department of Territory and Municipal Services
var.	Variety
4WD	Four-wheel-drive vehicle

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

Biosis Research Pty Ltd has been engaged by the ACT Government Land Development Agency to conduct a program of targeted surveys for threatened reptiles prior to the planned urban release of Lawson South (the 'study area').

The purpose of these surveys is to inform (via the 'Referral of Matters of National Environmental Significance' process) the Commonwealth Government Department of Sustainability, Environment, Water, Population and Communities assessment of the development of Lawson South against the provisions of the *Environment Protection and Biodiversity Conservation Act 1999*.

This report documents the targeted surveys conducted by Biosis Research to identify the potential habitat for Striped Legless Lizard (*Delma impar*) within the study area and to ascertain the presence or absence of the species.

The current location and extent of the potential habitat for *D. impar* was determined and mapped via an extensive review of relevant published and unpublished literature (i.e. past surveys, recovery plans etc.), a review of previously completed vegetation mapping, and the conduct of field surveys to verify and ground-truth this mapping.

A substantial component (approximately 54ha) of the study area was determined to support native grassland (of varying classification and quality), consistent with the definition of 'potential habitat' for *D. impar*.

A broad scale and intensive program of targeted surveys for *D. impar* was subsequently conducted throughout the sections of the study area assessed as supporting potential habitat for the species. This program consisted of the following.

1. Targeted pitfall trapping surveys resulting in the completion of 1400 functional trap days (i.e. 50 pitfall traps monitored 28 times) between the 27th of November 2010 and the 8th of January 2011. The pitfall trapping methodology and plan was developed in accordance with the ACT Government Striped Legless Lizard Survey Guidelines and was approved by the Conservation, Planning and Research unit of the ACT Government Department of Territory and Municipal Services.
2. Targeted artificial shelter (roof tile) surveys resulting in the completion of 800 checks (i.e. 200 tiles checked four times over three weeks) between the 8 h of January 2011 and the 27th of January 2011.

The completed intensive program of targeted surveys for *D. impar* (using both the pitfall trapping and artificial shelter techniques) did not detect the presence of *D. impar* within the study area.

Whilst it is never possible to unequivocally determine from negative survey results, that a fauna species does not occur within a given area of potential habitat, in light of the results of this study it is considered reasonable to conclude that the study area does not currently support a substantial population of *D. impar*.

Based on the results of this study, it is considered unlikely that the planned development of Lawson South would have a 'significant impact' upon *D. impar* as a Matter of National Environmental Significance pursuant to the *Environment Protection and Biodiversity Conservation Act 1999*. As such, Referral of the 'Action' (i.e. development of the study area) due to potential impacts upon *D. impar* is considered unwarranted.

2.0 INTRODUCTION

The Australian Capital Territory (ACT) Government Land Development Agency (LDA) is currently managing the urban planning and design for the release of Territory owned land known as Block 2, Section 13 located in the future suburb of Lawson, ACT (the 'study area'). This land release encompasses the southern section of Lawson and is thus referred to as Lawson South. Figure 1 illustrates the location of the study area in the broader Belconnen context.

Biosis Research Pty Ltd has been engaged by the LDA to conduct a concurrent program of targeted surveys for threatened reptiles at four locations within the ACT, the study area being one of these locations.

This report documents the targeted surveys conducted by Biosis Research to identify the potential habitat for Striped Legless Lizard (*Delma impar*) within the study area and to ascertain the presence or absence of the species.

Delma impar is listed as 'vulnerable' pursuant to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the ACT *Nature Conservation Act 1980* (NC Act). This report will act to inform (via the 'Referral of Matters of National Environmental Significance' process) the Commonwealth Department of Sustainability, Environment, Water, Population and Communities' (SEWPAC) assessment of the development of Lawson South against the provisions of the EPBC Act.

With regard to the above, this report provides the following.

A. In Section 3 Aims – A description of the aims and objectives of this study.
B. In Section 4 Background relating to the study area and Striped Legless Lizard – Background information relating to the study area and *D. impar* (i.e. species morphology, habitat, ecology etc.).
C. In Section 5 Methodology – Details of the methodology used during the completed *D. impar* habitat assessment and targeted surveys for *D. impar*.
D. In Section 6 Results – Details of the results gained during the *D. impar* habitat assessment and targeted surveys for *D. impar*.
E. In Section 7 Discussion – Detailed discussion and recommendations relating to the results of the study and associated land management implications.

3.0 AIMS

The general aim of this study was to carry out a program of surveys that will inform the LDA and the Commonwealth regarding the occurrence of *D. impar* within the study area.

This general aim was met through meeting the following specific objectives.

1. Completion of a review and field verification of previously completed assessment and mapping of the grassland vegetation communities occurring within the study area. This task assisted in accurately determining the location and extent of potential habitat for *D. impar* within the study area.
2. Completion of an assessment of the study area in order to determine the location and extent of the land considered to constitute potential habitat for *D. impar*. This assessment has been based primarily on current floristic composition and structure, however connectivity and other factors have also been taken into consideration.
3. Completion of a program of targeted surveys using both the 'pitfall trap' and 'artificial shelter' techniques, aimed a detecting *D. impar* should the species occur within the study area. The positioning of the pitfall trap and artificial shelter surveys was determined taking into account the results of the completed assessment of potential habitat.
4. Provision of a detailed presentation and assessment of the study findings relating to:
    a. the existing location and extent of the potential habitat for *D. impar* within the study area; and
    b. the recorded presence or absence of *D. impar* within the study area.
5. Provision of a detailed discussion relating to the significance of the study findings and the potential impacts of and implications for, the proposed urban development of the study area.

4.0 BACKGROUND

4.1 Study Area

4.1.1 Description of study area and surrounds

The study area encompasses 99.33ha of ACT owned land known as Block 2, Section 13 located in the future suburb of Lawson South. The study area is bordered to the south by Ginninderra Drive, to the east by Baldwin Drive and to the west by Lake Ginninderra. The 108ha block of 'National Land' (Commonwealth land containing the decommissioned Belconnen Naval Transmission Station (BNTS) managed by the Department of Defence) adjoins the northern boundary of the study area. Figure 1 illustrates the location of the study area within the broader North Canberra region.

Under recent amendments to the ACT Territory Plan, the study area was divided into the following land use designations or 'Zones':

- Residential – RZ1 – Suburban;
- Residential – RZ4 – Medium Density Residential;
- Residential – RZ5 – High Density Residential;
- Commercial – CZ5 – Mixed Use;
- Community Facility – CFZ – Community Facility;
- Transport and Services – (TSZ1 – Transport, TS72 – Services):
- Urban Parks and Recreation – PRZ1 – Urban Open Spaces; and
- Non Urban – NUZ3 – Hills, Ridges and Buffers.

4.1.1.1 Landform, topography and soils

The topography of the study area ranges from steep sloping land to gently undulating land. Reservoir Hill (638m AHD) comprises the southern end of the substantial central ridgeline which runs from this point northeast through the eastern section of the study area into the adjoining BNTS land to the north. The upper eastern, western and southern slopes of Reservoir Hill are moderately steep (approximately 18% to 28%). Further down-slope the land becomes undulating and then gently undulating closer to the boundaries of the study area. The aspect of the land with the study area is greatly varied due to the prominence and largely central location of Reservoir Hill and the adjoining ridgeline.

The majority of the study area is well drained (primarily due to topography). The only substantial drainage feature within the study area is College Creek which enters at the southeast corner, runs along the southern boundary and then discharges into Lake Ginninderra. In addition, a number of minor ephemeral drainage lines run down the western slopes of the ridgeline and a similar drainage line runs southward through the southeast section of the study area, parallel with Baldwin Drive.

Maunsell (2002) describe the geology of the study area as dominated by fine-grained sedimentary rock of the Pittman Formation and State Circle Shale and Black Mountain Sandstone. In addition, small areas of younger geology are present along Ginninderra Creek

which consist of younger, shallow-marine sediments (Maunsell 2002). Top soil depths range from 0.05m to 0.3m across the study area and clayey sand, gravely/sandy/silty clay and silty gravel comprise the dominant soils (Maunsell 2002).

4.1.1.2 Vegetation

Pre European settlement, the majority of the study area is expected to have supported a varying mosaic of temperate woodlands and lowland native grasslands (ACT Government 2005). Evidence of the pre-clearance woodland which occurred throughout much of the study area remains as scattered remnant live eucalypt trees, stags (dead trees) and stumps. The woodland communities within the study area have been either completely or partially cleared of the canopy and midstorey strata and now largely consist of secondary grassland.

Eco Logical Australia (2008) completed a detailed assessment of the vegetation communities occurring within the study area. This assessment was reviewed, ground-truthed and generally confirmed by David Hogg Pty Ltd (2010). The assessment of vegetation communities completed for this study on the 9th of November was conducted to inform an assessment of the location and extent of potential habitat for *D. impar* within the study area. The assessment did not observe any substantial changes in the boundary location or floristic composition of the vegetation communities from those mapped by Eco Logical Australia (2008). As assessed and ground-truthed during this study, the vegetation communities supporting a groundstorey dominated by native tussock grasses are presented in Figure 2 and described in the following.

1. Natural Temperate Grassland – *Austrodanthonia* Grassland Association. Two small highly modified patches of this community were identified, one occurring in the south-eastern section of the study area and the other occurring in the central northern section of the Study area, adjacent to the boundary with the BNTS. The native grass and forb diversity within these small patches was assessed as being sufficient to satisfy the criteria for the endangered ecological communities 'Natural Temperate Grassland of the Southern Highlands of NSW and the ACT' listed under the EPBC Act and 'Natural Temperate Grassland' listed under the NC Act (Eco Logical Australia 2008). The grass component of this community is dominated by the native tussock grass Wallaby Grasses (*Austrodanthonia* spp.) with scattered tussocks of Tall Speargrass (*Austrostipa bigeniculata*).

2. Native Pasture. This community is a form of lowland native grassland that has been modified to a point at which, due to the low or absent cover and diversity of native forbs, can no longer be considered to constitute Natural Temperate Grassland (ACT Government 2005). Eco Logical Australia (2008) assessed substantial portions of the lower undulating land in the eastern and western sections of the study area, as supporting this community. This community is dominated to varying degrees by the native tussock grasses Speargrasses (*A. scabra* var *falcata*, *A. bigeniculata*), Kangaroo Grass (*Themeda triandra*) and Wallaby Grasses.

   The northeast potion of the study area (occurring to the west of the Baldwin Drive – Maribyrnong Avenue intersection) currently supports a substantial cover of exotic weeds, primarily Saffron Thistle (*Carthamus lanatus*). It is likely that the wet 2010 winter and spring has facilitated the proliferation of this weed within this area.

   The thin band of Native Pasture occurring within the section of the study area protruding to the north adjacent to Baldwin Drive was maintained to approximately

100mm in height (via slashing) at the time of this study. Similarly, a 30m wide band along the inside of the eastern boundary of the study area was also maintained to approximately 100mm. Slashing these areas is required for bushfire hazard reduction purposes (A. Nugent pers. comm.).

3. Yellow Box – Red Gum Grassy Woodland. A substantial area located on the lower, northwest slopes of Reservoir Hill supports a substantially modified example of this woodland community. Although this community supports a groundstorey dominated by Tall Speargrass and other native tussock grasses, the sparseness of the canopy and very low native forb diversity prevent the community from constituting the endangered ecological community listed pursuant to the EPBC Act and the NC Act (Eco Logical Australia 2008).

   Two areas located on the eastern and western lower slopes of the central ridge, with similar elevation as the above woodland community, support a secondary grassland derived from the complete clearance of the canopy. These areas support a similar native tussock grass dominated, low diversity grassland community.

4. Broad-leaved Peppermint – Apple Box Woodland. An area located in the south-eastern section of the study area supports a substantially modified example of this woodland community. The groundstorey of this community is low in native grass and forb diversity and is dominated by Tall Speargrass, Wallaby Grasses and Redgrass (*Bothriochloa macra*).

5. Red Stringybark – Scribbly Gum Woodland – Secondary Grassland. This community encompasses a substantial area located along the upper western slopes of the central ridge and to the south of Reserviour Hill. The canopy of this community has been largely cleared (excepting a few remaining remnant trees) and, as such, the community occurs as secondary grassland with low native grass and forb diversity, dominated by the native tussock grasses Tall Speargrass and Wallaby Grasses. The northern section of this community supports a high density of Saffron Thistle.

4.2 Striped Legless Lizard

4.2.1 Morphology, Habitat and Ecology of the Striped Legless Lizard

Morphology

The Striped Legless Lizard (*Delma impar*) (Fisher 1882) is a member of the reptile family Pygopodidae (flap-footed legless lizards). Pale grey-brown above, usually with a series of dark brown or blackish dorso-lateral and lateral longitudinal stripes along the length of the body and tail (Cogger 1994). In some individuals, particularly juveniles, stripes may be very faint or absent (Robertson and Smith 2010). Most individuals have yellow coloration on the infralabial and adjacent gular scales, extending back to the tympanum (Coulson 1990). Adult (non gravid) *D. impar* are slightly thicker than a pencil with a average snout-vent length of 90mm, a maximum total length of 300mm and average body weight of 4.1 grams (Cogger 1994, Coulson 1990). Plate 1 provides a photograph of a *D. impar* recorded in the ACT.

Plate 1. *Delma impar* (R. Speirs - Biosis Research 2010).

The nasal and first supralabial scales are fused anterior to the nostril, so that the nostril lies in a single, semi-divided scale (Cogger 1994). Given the considerable variation in colour and pattern (i.e. intensity and distinction of striping etc) evident in *D. impar*, this nasal scale configuration is a useful basis for distinguishing the species from the Olive Legless Lizard (*D. inornata*). This closely related but considerably larger species (125mm snout-vent length and with nostril bordered by three scales (Cogger 1994)) also inhabits temperate grasslands in the ACT region. As such, it is important to use the nasal scale configuration to accurately distinguish inconspicuously marked *D. impar* recorded during surveys from *D. inornata*. Whilst a past extensive survey conducted by Osborne *et al* (1993) found that *D. impar* and *D. inornata* are rarely recorded in microsympatry, a recent survey completed by David Hogg Pty

Ltd & Rowell (2011) south of Kenny, ACT, noted the presence of significant numbers of both species occurring within a 15ha site. Osborne *et al* (1993) noted that *D. inornata* inhabits a wider range of habitats, including open woodland and pasture-dominated areas.

Legless lizards superficially resemble juvenile snakes, however upon examination, they can be readily distinguished from snakes by having a visible ear opening, fleshy broad tongue, the presence of remnant hind limbs (reduced to two small flaps near the vent) and a tail that can comprise up to 70 percent of the entire length, which can be voluntarily shed (ACT Government 1997).

Habitat

Delma impar primarily inhabits lowland native grasslands dominated by perennial, tussock forming native grasses such as Kangaroo Grass (*Themeda triandra*), Speargrasses (*Austrostipa* spp.) and Wallaby Grasses (*Austrodanthonia* spp.) (Coulson 1990). In the ACT, *D. impar* are found in both primary (i.e. Natural Temperate Grassland) and secondary grassland (i.e. native grassland that exists post clearing of woodland) but may be restricted to secondary grassland within two kilometres of primary grassland (Dorrough 1995).

Rauhala *et al* (1995) reported that the presence of Tall Speargrass (*Austrostipa bigeniculata*) is a particularly important habitat feature for *D. impar*. While *D. impar* are restricted to grasslands and grassy woodlands, the species is not restricted to native or primary grassland (Robertson & Smith 2010). The species has been recorded in areas dominated by exotic tussock forming grasses, notably Phalaris (*Phalaris aquatica*) and Cocksfoot (*Dactylis glomerata*) (Coulson 1995; Rauhala *et al* 1995). However it is not known whether such vegetation can support the species in the long term (Rauhala *et al* 1995). A defined tussock structure appears to be an important habitat feature of the grasslands where *D. impar* occur. In addition, it is thought that the density (relatively high) and continuous nature of a grassland may be as or more important to the persistence of *D. impar* than floristic composition (Robertson & Smith 2010).

While the precise utilisation of grass tussocks is not known, it is thought that *D. impar* may shelter and over-winter at the base of grass tussocks (ACT Government 1997). In the ACT, *D. impar* have been recorded sheltering in artificial arthropod burrows installed to survey for Grassland Earless Dragons (*Tympanocryptis pinguicolla*) (Osborne & Dimond 2008), suggesting that the species will also shelter below ground where such habitat features exist.

The majority of the sites where *D. impar* persist are thought to have been subject to low to moderate intensity of past agricultural disturbance (Coulson 1990; ACT Government 1997). High impact agricultural land use practices including heavy and prolonged grazing and regular ploughing are thought to be particularly incompatible with the persistence of the species (Coulson 1990; Dorrough 1995).

Ecology

Delma impar is known to prey on a variety of invertebrates including insects (crickets, grass hoppers, caterpillars etc) and arthropods (spiders) (Coulson 1990; Nunan 1995). Nunan (1995) found that *Lepidoptera* larvae (caterpillars) comprise a substantial component of the diet of *D. impar*.

Delma impar is considered to be a diurnal, surface active species, active from September to April with a peak in activity in the ACT in November – December (Robertson & Smith 2010; Kukolic 1994). An oviparous species (egg laying alike all *Delma* species), most individuals are caught in November and December when it is thought that there is an increase in movement by both sexes associated with mating and egg laying (Robertson & Smith 2010).

Eggs (usually two) are laid in December (Cogger 1994; ACT Government 1997). It is thought that most clutches are laid within the base of grass tussocks. *D. impar* eggs have been discovered laid in artificial arthropod burrows installed to survey for Grassland Earless Dragons in the ACT (M. Evans pers. comm.; Osborne & Dimond 2008). Such observations suggest that, in the ACT at least, *D. impar* will lay eggs underground or under part-buried surface objects where such opportunities exist. Incubation periods ranging between 35 and 60 days have been observed in captivity under ideal conditions, however, the incubation period is likely to be longer in the field (ACT Government 1997).

The longevity of the species is largely unknown however adults have been recaptured in the wild almost seven years after first capture (Rauhala 1997). Adults have been held in captivity for twelve years and estimations of lifespans of wild *D. impar* start at ten years (Robertson & Smith 2010; Dorrough 1995).

Whilst individual *D. impar* have been recorded moving over 20m in one day, recapture data suggests that these movements are likely to be associated with reproductive activity and that the species has a very small home range, conservatively within $10m^2$ (Robertson & Smith 2010).

As is typical of many cryptic wildlife species, the inherent difficulties associated with monitoring populations of *D. impar* have prevented accurate determination of population size (Robertson & Smith 2010).

4.2.2 Distribution of the Striped Legless Lizard

4.2.2.1 Regional distribution

The geographic range of *D. impar* is confined to south-east Australia (Cogger 1994). Populations occur at scattered locations in Victoria (primarily on the basalt plains to the north and west of Melbourne), and past recordings of the species have been made at scattered locations in New South Wales including Yass, Goulburn, Cooma, and Batlow (ACT Government 1997). A number of small populations also exist in the extreme south-east of South Australia (Robertson & Smith 2010).

Delma impar is considered to have suffered a substantial contraction across its geographic range, in terms of both distribution and population size since European settlement (Coulson 1990; ACT Government 1997). The species is known to have disappeared from many sites (Robertson & Smith 2010).

It is likely that prior to European settlement, *D. impar* would have inhabited large expanses of the Natural Temperate Grassland which extended across in excess of 20000 hectares of the ACT (ACT Government 1997). Most of this grassland type has been developed during the establishment and expansion of Canberra and suburbs (ACT Government 2005). As a result, the current known distribution of *D. impar* within the ACT comprises four disjunct populations located within the Jerrabomberra, Majura and Gungahlin Valleys and at Yarramundi Reach

(Rauhala *et al*. 1995; ACT Government 1997; M. Evans pers. comm.) Figure 3 shows the locations of previous *D. impar* recordings within the ACT. These populations are separated from one another by unsuitable habitat, roads and urban development, and thus no opportunity exists for natural dispersal between populations (ACT Government 1997).

4.2.2.2 Local distribution

The study area (and the BNTS adjoining the northern boundary) is not considered to constitute part of any of the four recognised populations. Pitfall surveys conducted at Bruce (approximately 300m to the southeast of the study area) and within Giralang to the north of the BNTS (approximately 2km to the north of the study area) failed to record *D. impar* (Rauhala *et al* 1995). HLA Envirosciences (2001) noted that the BNTS provided potentially high quality habitat for *D. impar*. Subsequently, surveys for *D. impar* were conducted across the BNTS site in 2002 with *D. impar* being recorded at two locations within the band of high quality Dry Themeda Grassland in the eastern portion of the BNTS, adjacent to Baldwin Drive (HLA Envirosciences 2002) (refer Figure 4). HLA Envirosciences (2002) also surveyed the study area in 2002 with no *D. impar* being recorded. A survey by Eco Logical Australia (2008) involving the monitoring of 64 tiles (eight x 8 tile grids) was conducted on the site between the 28th of February and the 10th of March 2008. This survey did not record the presence of *D. impar*, however one Olive Legless Lizard (*D. inornata*) was recorded in the south-eastern section of the study area.

Habitat connectivity between the study area and the BNTS is currently largely intact along the majority of the boundary. However, given the much higher quality of the habitat within the BNTS, it is unlikely that *D. impar* would choose to move from the BNTS into the study area (should a population still exist within the BNTS). As the suburb of Lawson (comprising the study area and the BNTS) is bordered on three sides by arterial roads, and one side by Lake Ginninderra, no opportunities exist for more widespread dispersal.

4.2.3 Conservation of the Striped Legless Lizard

4.2.3.1 Threats to the Striped Legless Lizard

The main threats to the continued persistence of Striped Legless Lizard as described in the 'ACT Government – Action Plan No.2 – Striped Legless Lizard *Delma impar*' (Action Plan No.2) (ACT Government 1997) are as follows.

1. Loss and fragmentation of habitat through clearing of grasslands for urban, industrial and infrastructure development and for agricultural purposes.

   Lowland Natural Temperate Grassland is one of Australia's most threatened ecological communities with approximately 99.5 percent destroyed or substantially altered since European settlement (ACT Government 2005). As *D. impar* is restricted to areas of native grassland, grassy woodland and nearby exotic pasture (Robertson & Smith 2010), it is no surprise that the species has similarly suffered a significant decline. As such, the further loss or fragmentation of *D. impar* habitat has the potential to result in further declines in *D. impar* distribution and abundance.

2. Modification and degradation of grassland habitat through incompatible and inadequate land management practices.

   Delma impar can be eliminated from an area of habitat by extended high intensity grazing, pasture improvement, ploughing, drought and other heavy disturbance

(Robertson & Smith 2010). As such, appropriate agricultural management regimes and practices must be implemented in order to prevent modification and degradation of grasslands inhabited by *D. impar*.

3. Other potential effects of urbanisation, including increased incidence of predation by domestic animals and increased frequency of fires.

Introduced predators, notably feral and domestic Cat (*Felis cattus*) and the Red Fox (*Vulpes vulpes*) are likely to prey upon *D. impar*. Such impacts are likely to be of particular importance in areas of *D. impar* habitat located in close proximity to suburban environs. Increased burn frequency (human induced or wildfire) adversely impacts upon the grassland floristic composition and structure of *D. impar* habitat (i.e. facilitating exotic weed encroachment, reducing shelter etc). Populations are often not provided with sufficient time to recover from mortality resulting from previous fires.

4.2.3.2 Existing conservation of the Striped Legless Lizard in the ACT Region

The ACT Flora and Fauna Committee (the Committee) was established via a 1994 amendment to the ACT *Nature Conservation Act 1980* (NC Act). The Committee is responsible for assessing the conservation status of the flora, fauna and ecological communities of the ACT. Where the Committee believes that a species or ecological community is threatened with extinction, it is required to advise the Minister for the Environment, Land and Planning (now the Minister for Planning) and recommend that a declaration be made accordingly (ACT Government 1997). An Action Plan is required in response to each declaration and must include proposed actions for the protection of the threatened species or ecological community.

In 1997, the Committee determined that *D. impar* satisfied the criteria for listing as 'Vulnerable' and the species was subsequently declared to be a 'Vulnerable' species under Section 21 of the ACT NC Act, Determination No. 89 of 1997. In accordance with this declaration, the species was given 'Special Protection Status' and listed under Schedule 6 of the NC Act. The Action Plan for *D. impar* (Action Plan No.2) was published in 1997 and amalgamated into the broader 'Action Plan 28 - ACT Lowland Native Grassland Conservation Strategy' in 2005 (ACT Government 2005).

The primary conservation objective for *D. impar* in the ACT as described in Action Plan No.2 is to –

> *'Maintain in the long term, viable, wild populations of Delma impar as a component of the indigenous biological resources of the ACT and as a contribution to regional and national conservation of the species (ACT Government 1994).*
>
> *This primary objective is to be achieved by:*
>
> - *improving understanding of the biology and ecology of the species as the basis for managing its habitat in reserves, other managed complementary areas and other sites where it persists; and*
> - *protecting several viable populations in situ, in a cluster of sites in native grassland across the geographic range of the species in the ACT.'*

Action Plan 28 details the reserves established for the protection and preservation of the grasslands of the ACT, including associated threatened flora and fauna. The establishment of the Gungahlin Grassland Reserves (comprising Mulanggari Nature Reserve, Gungaderra

Nature Reserve and Crace Nature Reserve, total combined area of 540ha) has resulted in the protection in perpetuity of the most significant population of *D. impar* within the ACT. An additional reserve (totalling approximately 470ha) has recently been established in the Jerrabomberra Valley. The primary purpose of this new grassland reserve is to protect one of only two populations of Grassland Earless Dragon occurring in the ACT, however much of this habitat is known to also support *D. impar*.

The additional sites supporting known populations of *D. impar* within the ACT are located on a number of parcels of land and are the subject of various tenures: Commonwealth Government, ACT Government non-leasehold, private leasehold. The sites on Commonwealth Land (most notably associated with the Defence facilities in the Jerrabomberra Valley (HMAS Harman) and Majura Valley (Majura Firing Range)) are the subject of a 'Memorandum of Understanding' between the ACT Government and the relevant Commonwealth departments and agencies (Department of Defence, Department of Sustainability, Environment, Water, Population and Communities, National Capital Authority and CSIRO) (Robertson & Smith 2010). The Memorandum of Understanding promotes an understanding of the importance of appropriate property management in facilitating lowland grassland (and associated threatened fauna) conservation.

Areas of *D. impar* habitat on private leasehold land in the Jerrabomberra Valley are subject to a 'Direction to Landowners' from the ACT Conservator of Flora and Fauna to prevent land management practices that are likely to have an adverse effect on grassland reptile populations (Robertson & Smith 2010).

5.0 METHODOLOGY

5.1 Approach

This study involved four main tasks: a desktop review of relevant literature; a review of previously completed vegetation community mapping; ground-truthing and mapping of the location and extent of potential habitat; and an intensive program of targeted pitfall and artificial shelter (roof tile) surveys. Detailed descriptions of each of these four tasks are provided below.

5.2 Desktop Review

Existing information on *D. impar* was obtained from a range of sources, including: database searches; consultation with government and non-government experts; relevant departmental web pages; and, previous studies undertaken on the species, particularly with relevance to the locality and wider ACT region. A full list of documents cited is provided in the References section of this report.

Habitat mapping and records of past *D. impar* recordings within the ACT were obtained from the Conservation, Planning and Research (CPR) unit of the ACT Government Department of Territory and Municipal Services (TAMS).

A number of particularly relevant and useful specialist, technical reports and other resources relating to *D. impar* within the ACT and region were examined, these included the following.

- *National Recovery Plan for the Striped Legless Lizard (Delma impar)* (Draft). (Robertson & Smith 2010).
- *Action Plan No.28 – A Vision Splendid of the Grassy Plains Extended: ACT Lowland Native Grassland Conservation Strategy.* (ACT Government 2005).
- *Action Plan No.2 – Threatened species - Striped Legless Lizard (Delma impar).* (ACT Government 1997).
- NSW Government – DECCW Species profile for *Delma impar*.

  http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=1021
- SEWPAC Species Profile and Threats Database for *Delma impar*.

  http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1649

5.3 Potential Habitat Assessment, Delineation and Mapping

Potential habitat was defined in accordance with the description of *D. impar* habitat provided in Section 4.2.1 herein. Using this description and the detailed vegetation community mapping prepared by Eco Logical Australia (2008) and generally confirmed by David Hogg Pty Ltd (2010), an onsite survey was conducted on the 9th of November 2010 to assess, delineate and map the current on-ground extent of *D. impar* potential habitat within the study area. The location and extent of potential habitat within the study area was marked directly onto a high resolution, orthorectified aerial photograph.

5.4 Targeted Striped Legless Lizard Surveys

5.4.1 Pitfall Surveys

Pitfall trapping has long been considered the standard technique to survey for this cryptic and difficult to survey species. While numerous variations of the technique have been used to survey for *D. impar*, the standard design consists of one or more buckets (or similar) set into the ground with a drift fence running over the bucket to guide animals into the bucket.

The optimal time to survey for *D. impar* using pitfall traps is generally considered to be October to December (ACT Government 2010). This is the period when *D. impar* are most active due to movements associated with mating and egg laying (Robertson & Smith 2010; Kukolic 1994), and thus, are most likely to be caught in pitfall traps.

The current surveys commenced on the 27th of November 2010 following a week of pitfall installation running from the 22nd of November until the 26th of November.

Pitfall traps were employed in this study as the primary survey technique to survey for *D. impar* within the study area.

5.4.1.1 Survey timing and duration

The timing and duration of the current program of pitfall trapping surveys was as follows.

1. Potential habitat assessment, delineation and mapping (as detailed above). This task was completed on the 9th of November 2010.
2. Preparation and submission of detailed Survey Methodology and Plan for assessment and approval by TAMS – CPR. This task was completed on the 12th of November 2010 and approved without amendment by TAMS – CPR on the 15th of November 2010.
3. Installation of pitfall traps (as detailed below). This task was completed on the 26th of November 2010.
4. Commencement of pitfall trap monitoring (as detailed below). Daily monitoring of pitfall traps commenced on the 27th of November 2010 and concluded at the completion of 28 days of monitoring on the 8th of January 2011. Pitfall traps were not able to be monitored for a total of 14 days during this period due to impacts of unseasonal wet weather. It must be noted that a significant rainfall event causes the loss of monitoring days in the following manner:

- one day on (or prior if significant rain is forecast) the first day of significant rainfall when the traps are closed;
- one day for each succeeding day of rain;
- approximately two to three days to allow pitfalls to drain; and
- one day when pitfalls are repaired and re-opened.

5. Removal of pitfall traps (as detailed below). Pitfall traps were removed on the 12th of January 2011.

5.4.1.2 Survey methodology

The pitfall trapping methodology used to survey for *D. impar* was consistent with the *Survey Guidelines for Striped Legless Lizard* (the 'SLL Survey Guidelines') developed by the ACT Government (ACT Government 2010). A copy of the SLL Survey Guidelines is provided in Appendix A.

Given the large size of the study area and the consequent large number of pitfall traps required (i.e. 50 pitfall traps), pitfall traps were installed in arrays of five pitfall traps spaced at five metre intervals along a 25m drift fence (refer Plate 2 below).

Pitfall trap arrays were located throughout the study area in a manner that would provide even survey coverage across all areas of assessed potential habitat within the study area. Obvious drainage features and dense infestations of weeds (notably Saffron Thistle and Serrated Tussock (*Nassella trichotoma*)) were avoided. The locations of pitfall arrays are illustrated on Figure 4 and MGA (Zone 55) Coordinates are provided in Table 1 below.

Table 1. Locations of pitfall arrays

Pitfall Array Name	MGA Coordinates	
	Easting	Northing
LAW-P1	690500.6	6099512
LAW-P2	690518.1	6099670
LAW-P3	690048.8	6099873
LAW-P4	689954.9	6099851
LAW-P5	689704.8	6099856
LAW-P6	689846.6	6099606
LAW-P7	690041.7	6099457
LAW-P8	689952.0	6099384
LAW-P9	690223.1	6099127
LAW-P10	690268.4	6099206

The study area is currently subject to a pastoral lease which requires stock grazing to maintain grass levels and associated bushfire hazard. To this effect, the Lessee has 75 cattle grazing the study area. Temporary fencing was placed around each pitfall array to exclude cattle, thereby preventing damage to the pitfall traps (and associated impacts upon the survey) and potentially to the cattle (refer Plate 3 below).

Once installed, all pitfall traps were monitored before 12:00pm each day. On the few days of hot weather during the monitoring period (refer Appendix B), traps were monitored earlier in the day to minimise heat stress on captured vertebrates (notably amphibian by-catch).

During pitfall installation a suitable 4WD track was defined through the study area and this track was followed on each monitoring trip. Remaining on this track was considered important in order to minimise the area of the study area driven upon and to avoid grass-hidden tree stumps and rocky outcrops.

On each monitoring visit, each pitfall trap, (including the shelter tube and substrate placed in each pitfall) was thoroughly inspected with the aid long handles tongs, the ends of which are softened with a covering of rubber tape (Plate 4 below illustrates a functioning pitfall). All vertebrate captures were identified to the species level, photographed and immediately released at the base of a suitable grass tussock approximately 10m from site of capture (refer Appendix C for details of captured vertebrate fauna).

Any *Delma* (*D. impar* or *D. inornata*) captured were to be measured (approximate snout-vent length, total length), described (i.e. colouration and other notable features etc) and released as described above (note: as detailed in Section 6.2.1, no *Delma* were captured in the pitfall traps).

The scale pattern on the dorsal head of each individual *D. impar* is unique (much like human fingerprints), and can be used for identification of individuals (I. Smales pers. comm.). As such, a macro (close-up) digital photograph of the dorsal head of any *D. impar* captured was to be taken and submitted to TAMS - CPR for possible reference in future mark-recapture investigations for population size/density etc (note: as detailed in Section 6.2.1, no *Delma* were captured in the pitfall traps).

Large invertebrates capable of injuring vertebrate captures (centipedes, spiders, scorpions, etc) were removed from the pitfalls and placed at a distance from the array. Any invertebrates of conservation significance (namely Golden Sun moth (*Synemon plana*), Perunga Grasshopper (*Perunga ochracea*), Canberra Raspy Cricket (*Coorabarama canberrae*)) were carefully removed from the pitfall, photographed and released (refer Appendix C for details of captured notable invertebrate fauna).

Post completion of the monitoring period, all pitfalls were removed and holes were filled in by collapsing the surrounding soil. No soil or other potentially seed laden material was imported into the study area.

Plate 2. Pitfall trap installation (J. Dessmann - Biosis Research 2010).

Plate 3. Installed pitfall trap array (R. Speirs - Biosis Research 2010).

Plate 4. Open and functioning pitfall trap. Eastern Bearded Dragon captured during concurrent survey at Kenny, ACT (R. Speirs - Biosis Research 2010).

5.4.1.3 Weather conditions

The pitfall survey monitoring program ran from the 27th of November 2010 to the 8th of January 2011. Weather conditions during this period were variable, however episodes of unseasonal wet weather during the monitoring period resulted in the loss of 14 days and consequent extension of the planned survey duration. The precipitation recorded by the Bureau of Meteorology (BOM) at Canberra Airport during the pitfall monitoring period totalled 287mm. Appendix B summarises the weather observations, precipitation and temperature throughout the monitoring period.

Overall, the weather conditions during the monitoring period were substantially cooler with substantially higher precipitation than average.

5.4.1.4 Limitations

The completed program of targeted surveys for *D. impar* was impacted by the unseasonal wet weather experienced during the early part of the monitoring period. Despite locating pitfall arrays away from drainage lines and other wet areas of the landscape, rainfall was sufficient to require the closure of pitfalls for considerable periods and substantial repair work upon reopening.

The closure of the pitfall traps (due to wet weather) resulted in the loss of concurrent survey days and required the extension of the monitoring program into early January in order to achieve the total of 28 monitoring days stipulated in the SLL Survey Guidelines (refer Appendix A).

The first two weeks of January, whilst not generally considered the optimal survey period for *D. impar* (ACT Government 2010), is still considered acceptable (G. Baines pers. comm.). Given the very late 2010-2011 summer, extending the pitfall surveys into early January is not considered to be a significant limitation to the study. Furthermore, the wet 2010 winter and spring resulted in plentiful growth of both native and exotic plant species throughout the study area, providing optimal conditions to assess the vegetation cover and associated potential habitat for *D. impar*.

5.4.2 Artificial Shelter Surveys

Surveying for *D. impar* using artificial shelters (in the form of roof tiles), was first tested by Rauhala (1997) during surveys conducted at a number of areas within the ACT known to support populations of the species. Whilst varying degrees of success have been recorded (as is the case with all survey techniques for *D. impar*), the technique has become increasingly popular amongst practitioners across the geographical range of *D. impar*.

Surveying using artificial shelters involves the placement of standard concrete or terracotta roof tiles in grids or arrays within known or potential *D. impar* habitat. The SLL Survey Guidelines (refer Appendix A) state that artificial shelters are to be placed approximately one month prior to commencement of monitoring in order to allow the shelters to 'bed in' and become suitable habitat features for grassland reptiles. It is noted however, that *D. impar* have been recorded under artificial shelters as little as one week post placement (I. Smales pers. comm.; S. Sass pers. comm.) A full program of artificial shelter surveys is required to span a minimum of four months (i.e. one month for shelters to 'bed in' and three months of monitoring) (ACT Government 2010).

The optimal time to survey for *D. impar* using artificial shelters is generally considered to be September to December (ACT Government 2010). The early part of this period is when *D. impar* are most likely to benefit from the thermoregulatory properties offered by artificial shelters. Whilst this survey period is widely considered the optimal period for surveying for *D. impar* with artificial shelters, there is a paucity of data relating to the success of surveys conducted from January to April. Whilst the thermoregulatory benefits of artificial shelters may be moot during particularly hot weather experienced during the summer months, *D. impar* are still likely to shelter underneath artificial shelters overnight and during cool or wet weather. In this regard, surveying using artificial shelters during the warmer months may provide useful results provided artificial shelters are turned very early in the morning.

The heavy and extended rainfall received in early December raised the concern that a full 28 day program of pitfall trap monitoring may not be able to be completed within the acceptable survey season (i.e. by the end of second week of January). In this regard, artificial shelters were employed in this study as a safeguarding action, to provide compensatory and additional survey effort should wet weather necessitate the extension of the pitfall trapping surveys beyond the acceptable survey season. As wet weather did not prevent the completion of a full program of pitfall trapping surveys within the acceptable survey season, the artificial shelter surveys should be regarded as an additional and complementary survey technique to survey for *D. impar* within the study area.

In addition to augmenting the pitfall trapping survey program, the artificial shelter surveys were conducted to increase the pool of knowledge regarding the effectiveness of the

technique for use in detecting *Delma* later than the specified September to December optimum survey period.

5.4.2.1 Survey timing and duration

The timing and duration of the current program of artificial shelter surveys is detailed in the following.

1. Placement of artificial shelters (as detailed below). This task was completed on the 20th of December 2010.
2. Commencement of artificial shelter monitoring (as detailed below). Weekly monitoring of artificial shelters commenced on the 8th of January 2011 (approximately three weeks post placement) and occurred four times over the following three weeks concluding on the 27th of January 2011.
3. Retrieval of artificial shelters. Artificial shelters were removed post completion of the above described monitoring period.

5.4.2.2 Survey technique

The artificial shelter surveys involved the placement of 200 standard concrete roof tiles in grids of 50 at four locations within potential habitat within the study area. The locations of the artificial shelter grids are illustrated on Figure 4 and MGA (Zone 55) Coordinates are provided in Table 2 below.

Table 2. Locations of artificial shelter grids

Pitfall Array Name	MGA Coordinates	
	Easting	Northing
LAW-T1	690109.6	6099918
LAW-T2	689704.7	6099780
LAW-T3	690277.1	6099570
LAW-T4	689990.1	6099326

In accordance with the SLL Survey Guidelines (refer Appendix A), each grid was placed in a configuration of 10 x 5 tiles with 5m spacing (Plate 5 below shows one of the artificial shelter grids).

Artificial shelters were placed and allowed to 'bed in' for approximately three weeks prior to first check and were then checked four times over the following three weeks.

Given the small number of cattle in the study area it was not considered necessary to construct temporary fencing around the grids. Over the course of the study cattle damage to tiles was limited to four broken tiles which were replaced when found.

All artificial shelters were monitored (lifted) between 6:00am and 7:30am on each monitoring day (i.e. once per week). The 4WD tracks defined through the study area during the pitfall trapping surveys were followed on each monitoring trip.

On each monitoring visit, each artificial shelter was lifted and all vertebrate captures were identified to the species level, photographed and immediately released at the base of a suitable nearby grass tussock (refer Appendix C for details of captured vertebrate fauna).

All *Delma* (*D. impar* or *D. inornata*) captured were measured (approximate snout-vent length, total length), described (i.e. colouration and other notable features etc) and released as described above.

The methodology (grid pattern etc), used to survey for *D. impar* was consistent with the SLL Survey Guideline (refer Appendix A). It is to be noted however that the following aspects of the artificial shelter survey do not accord with the SLL Survey Guideline.

1. The monitoring component of the artificial shelter surveys was conducted outside of the specified optimum survey period (i.e. monitoring during September to December).
2. The duration of the monitoring period (i.e. three weeks) is less that the twelve weeks specified.
3. The number of artificial shelters (i.e. 200) is less than the 500 that would be required if the artificial shelter surveys were to be the only survey method utilised.

Plate 5. Artificial shelter grid (R. Speirs - Biosis Research 2010).

5.4.2.3 Weather conditions

The artificial shelter survey monitoring program commenced on the 8th of January 2011 and occurred four times over the following three weeks concluding on the 27th of January 2011. Weather conditions during this period were variable and generally cooler than average. Appendix B summarises the weather observations, precipitation and temperature throughout the monitoring period.

The artificial shelter monitoring program was not delayed or otherwise impacted upon by inclement weather.

5.4.2.4 Limitations

The limitations that applied to the completed program of artificial shelter surveys were those posed by completing the program outside of the specified optimum survey period for *D. impar*. It is recognised that conducting artificial shelter surveys outside of the specified optimum survey period may have reduced the likelihood of recording *D. impar* within the study area, should the species be present. This limitation would likely prevent the program of artificial shelter surveys from being accepted as sufficient as a standalone survey for the presence/absence of *D. impar* within the study area.

Notwithstanding the above, given the very late, wet and cool 2010-2011 summer, it was considered that conducting the artificial shelter surveys later than the usual optimum survey period may potentially provide useful results in addition to those gained thorough the completed program of pitfall surveys.

The unseasonal cool weather experienced during the monitoring period did not adversely impact upon the artificial shelter surveys. To the contrary, it is considered that these weather conditions may have increased the amount of time that the shelters provided a suitable temperature microhabitat for grassland reptiles, and thus act to increase the likelihood of utilisation.

Nevertheless, it is recognised by the LDA and Biosis Research that this program of artificial shelter surveys was subject to a considerable degree of experimentation.

6.0 RESULTS

6.1 Potential Habitat Assessment and Mapping

As described under Section 4.2.1 herein, *D. impar* primarily inhabits lowland native grasslands dominated by perennial, tussock forming native grasses such as Kangaroo Grass, Speargrasses and Wallaby Grasses. In the ACT, *D. impar* are found in both primary (i.e. Natural Temperate Grassland) and secondary grassland (i.e. native grassland that exists post clearing of woodland). Whilst *D. impar* has been recorded in areas of degraded grassland dominated by tussock forming exotic pasture grasses (notably Phalaris and Cocksfoot), such habitat is considered to constitute marginal habitat for the species. In this regard, the primarily defining habitat feature for moderate or high quality *D. impar* potential habitat is suitable lowland native tussock dominated grassland.

The vegetation communities described in detail under Section 4.1.1.2 and presented in Figure 2, assessed as supporting a groundstorey dominated by native tussock grasses are as follows.

1. Natural Temperate Grassland – *Austrodanthonia* Grassland Association. All areas of this vegetation community are assessed as constituting potential habitat for *D. impar.*
2. Native Pasture. The thin band of Native Pasture occurring within the section of the study area protruding to the north adjacent to Baldwin Drive was maintained to approximately 100mm in height (via slashing) at the time of this study. Similarly, a 30m wide band along the inside of the eastern boundary of the study area was also maintained to approximately 100m. Slashing these areas is required for bushfire hazard reduction purposes (A. Nugent pers. comm.). These areas do not currently support the grassland structure necessary to support *D. impar* and are thus not considered to constitute potential habitat for the species. All other areas of Native Pasture with the study area are determined to constitute potential habitat for *D. impar*.
3. Yellow Box / Red Gum Grassy Open Woodland and Secondary Grassland. All areas of this vegetation community and derived secondary grassland are determined to constitute potential habitat for *D. impar*.
4. Broad-leaved Peppermint / Apple Box Open Woodland and Secondary Grassland. All areas of this vegetation community are assessed as constituting potential habitat for *D. impar.*
5. Red Stringybark / Scribbly Gum Open Woodland – Secondary Grassland. All areas of this vegetation community are assessed as constituting potential habitat for *D. impar.*

The accumulated 54ha area of these vegetation communities is determined to constitute the location and extent of potential habitat for *D. impar* within the study area (refer Figures 2 and 4). Plates 6 to 9 below provide representative photographs of the potential habitat for *D. impar* within the site.

Plate 6. Natural Temperate Grassland located in the north-central section of the study area (R. Speirs - Biosis Research 2010).

Plate 7. Natural Temperate Grassland located in the southeast section of the study area (R. Speirs - Biosis Research 2010).

Plate 8. Yellow Box / Red Gum Grassy Woodland – Secondary Grassland located on western slopes of Reservoir Hill (R. Speirs - Biosis Research 2010).

Plate 9. Native Pasture located in northeast section of the study area (R. Speirs - Biosis Research 2010).

6.2 Targeted Striped Legless Lizard Surveys

6.2.1 Pitfall Trapping Surveys

The targeted pitfall trapping surveys for *D. impar* resulted in the completion of 1400 functional trap days (i.e. 50 pitfall traps monitored 28 times) between the 27th of November 2010 and the 8th of January 2011. Figure 4 illustrates the locations of each pitfall trap array.

No *D. impar* or other threatened or otherwise notable vertebrates were captured during the pitfall trapping survey program.

A full list and representative photographs of vertebrate fauna captured in the pitfall traps is provided in Appendix C.

Whilst not targeted or considered as part of this study, two notable invertebrate species were captured incidentally during the pitfall trapping survey program: Golden Sun moth and Canberra Raspy Cricket. Details and representative photographs of these invertebrate captures are provided in Appendix C. An abundance of Wolf Spiders (*Lycosa godeffroyi*) was noted throughout the study with most pitfall traps containing at least one specimen on each monitoring event.

6.2.2 Artificial Shelter Surveys

The artificial shelter surveys for *D. impar* resulted in the completion of 800 checks (i.e. 200 tiles checked four times over three weeks) between the 8th of January 2011 and the 27th of January 2011 (conducted on the 8th, 14th, 21st and 27th of January 2011).

No *D. impar* or other threatened fauna were recorded under the artificial shelters.

Five common Olive Legless Lizards (*D. inornata*) were recorded utilising the artificial shelters. All *D. inornata* were recorded at different locations across three of the four artificial shelter grids. A full list and representative photographs of vertebrate fauna recorded under the artificial shelters is provided in Appendix C.

7.0 DISCUSSION

7.1 Study Findings

The general objective of this study was to identify the potential habitat for Striped Legless Lizard (*Delma impar*) within the study area and to conduct a program of targeted surveys aimed at detecting the species should it occur within the study area. In order to meet this objective, Biosis Research completed a broad scale and intensive program of targeted surveys for *D. impar* throughout the sections of the study area assessed as supporting potential habitat for the species.

This study consisted of the completion of four main tasks as follows.

1. Task 1 – Review of relevant literature (published and unpublished) and government databases and consultation with relevant government (ACT Government TAMS-CPR) and non-government herpetological experts. This review and consultation provided relevant background and advice regarding the occurrence, habitat, ecology and conservation of *D. impar* in the ACT region and wider geographical distribution.
2. Task 2 – Review of previously completed assessment and mapping of the grassland vegetation communities occurring within the study area. This review provided valuable background to the study and provided an indicative location and extent of potential habitat for *D. impar* within the study area.
3. Task 3 – Ground-truthing of the location and extent of potential habitat for *D. impar*. This involved an on ground assessment of the current floristic composition and structure of the vegetation throughout the study area. The results of this assessment were used to accurately delineate the location and extent of potential habitat for *D. impar* within the study area.
4. Task 4 – Completion of a program of targeted surveys using both the 'pitfall trap' and 'artificial shelter' techniques, aimed a detecting *D. impar* should the species occur within the study area.

As detailed in Section 6.1, a 54ha component of the study area was determined to support native grassland (of varying classification and quality), consistent with the definition of 'potential habitat' (refer Section 4.2.1 herein) for *D. impar*. The location and extent of potential habitat for *D. impar* within the study area is illustrated on Figure 4.

As facilitated by the above assessment, the program of targeted surveys for *D. impar* was conducted in a manner that provided a broad coverage (both geographically and floristically) of the potential habitat within the study area.

<u>The completed program of intensive pitfall trapping surveys did not detect *D. impar* within the study area</u>.

The completed program of pitfall trapping surveys is not considered to have been significantly impacted upon by the limitations discussed in Sections 5.4.1.4. With regard to seasonality and weather experienced during the surveys, it is relevant to note that *D. impar* were captured during the pitfall trapping program undertaken by Biosis Research

concurrently (and using the same survey methodology) at two of the three other concurrent study areas in the ACT.

The completed program of artificial shelter surveys did not detect *D. impar* with the study area, however five *D. inornata* were recorded utilising the artificial shelters (refer Appendix C). It is recognised that differing characteristics exist between the two species (i.e. ecology, habitat preference etc). Notwithstanding this, the two species are closely related and share very similar morphology and ecology. In addition, both species are known to actively utilise artificial shelters placed to survey for *D. impar* in the ACT (David Hogg Pty Ltd & Rowell (2011); S. Sass pers. comm.). In this regard, it is reasonable to suggest that *D. impar* would also have utilised (and likely been recorded underneath) the artificial shelters placed during this study, should the species occur within the study area.

As described above, the results of this study are summarised as:

a. the study area was found to support approximately 54ha of native grassland consistent with the definition of potential habitat for *D. impar*; and

b. the completed intensive program of targeted surveys for *D. impar* (using both the pitfall trapping and artificial shelter techniques) did not detect the presence of *D. impar* within the study area.

It is never possible to unequivocally determine from negative survey results, that a fauna species does not occur within a given area of potential habitat. This is particularly the case for cryptic, difficult to survey species such as *D. impar*. Nevertheless, at the completion of an intensive and broad ranging program of targeted surveys (such as that completed during this study), negative survey results provide a reasonable indication that the study area does not support a substantial population of the target species.

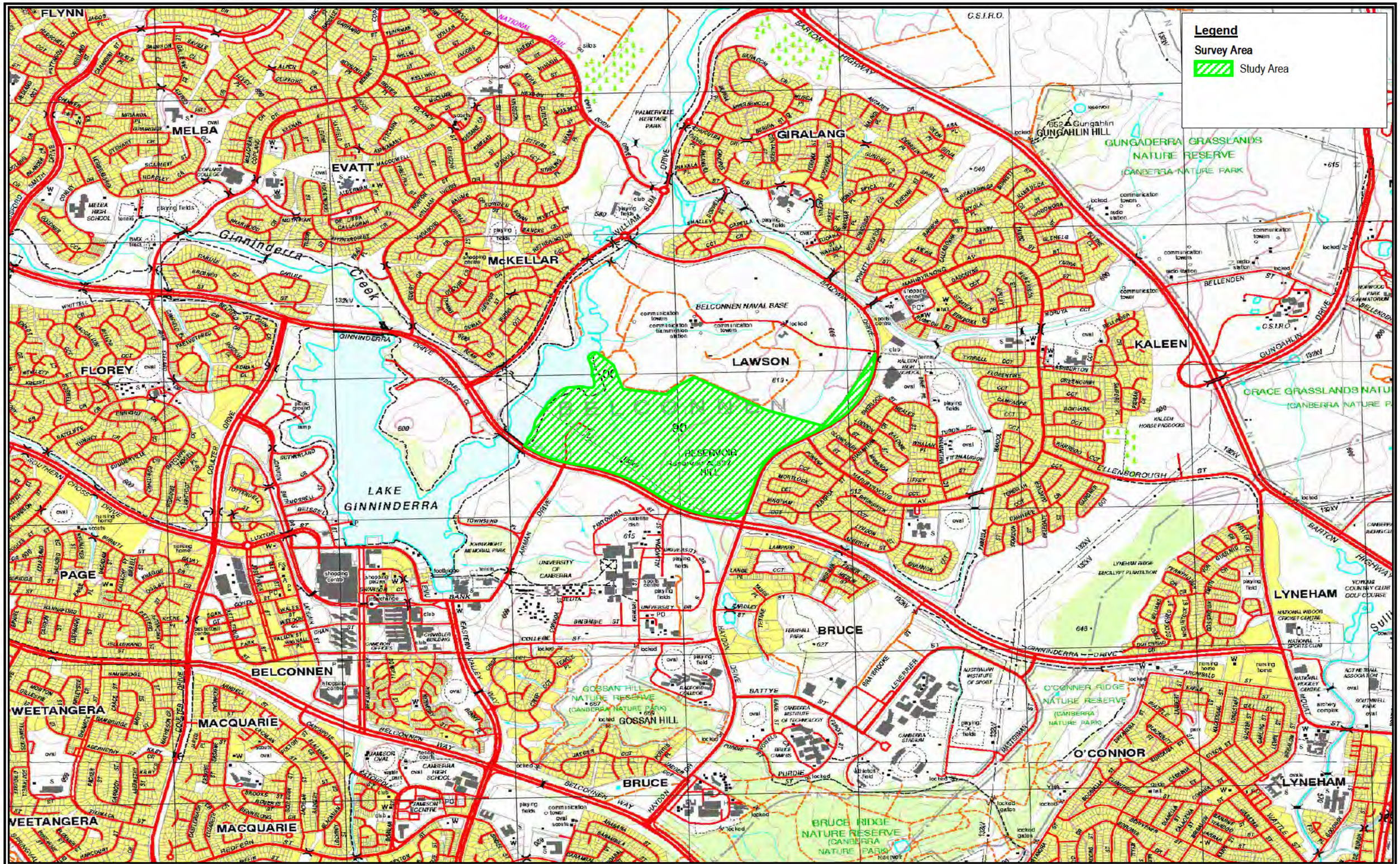
It is relevant to note that *D. impar* has not been previously recorded within the study area despite considerable past survey effort. The only previous recordings of *D. impar* within the vicinity of the study area were those gained during 2002 surveys completed by HLA Envirosciences (2002) within high quality Dry Themeda Grassland within the BNTS to the north of the study area (refer Figure 4). The grassland within the BNTS, whilst not specifically surveyed during this study, is generally of a much higher quality (i.e. higher native plant diversity, lower exotic weed content etc) than that within the study area. The difference in current grassland condition between the two areas is likely the result of the different past grazing regimes (i.e. the study area has been subject to many years of cattle and sheep grazing under pastoral lease whereas the BNTS has been grazed primarily by Eastern Grey Kangaroos (*Macropus giganteus*)).

In light of the results of this study, it is reasonable to conclude that the study area does not currently support a substantial population of *D. impar*.

7.2 Recommendations and Land Management Implications

Based on results of this study, it is considered unlikely that the proposed/planned urban development of the study area would have a 'significant impact' upon *D. impar* as a 'Matter of National Environment Significance' pursuant to the EPBC Act (Commonwealth of Australia 2008). As such, Referral of the 'Action' (i.e. development of the study area) due to potential impacts upon *D. impar* is considered unwarranted.

FIGURES



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Fyshwick
AUSTRALIAN CAPITAL TERRITORY 2609

Figure 1: Locality Plan - Lawson South

Date: 28 February 2011	Drawn by: ANP
File number: 12338	Checked by: RS
Location:-..P:\12300s\12338\Mapping\DRAFT Figures\Lawson South\12338 F1_Lawson Sth Locality.WOR	

Acknowledgements:
Topographic Image from Land and Property Management Authority 1:25000 topographic map series (2006)
This product incorporates Data which is copyright to the Commonwealth of Australia (c.2003-)

0 0.2 0.4 0.6 0.8 1.0
kilometres

Scale: 1:20,000 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

Figure 1

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TERRITORY 2609

Figure 2: Native Grassland and Grassy Woodland Vegetation Communities.

Date: 1 March 2011	Drawn by: ANP
File number: 12338	Checked by: RS
Location:-..P:\12300s\12338\Mapping\DRAFT Figures\Lawson South\12338 F2_Lawson Sth Vegetation.WOR	

0 55 110 165 220 275
metres

Scale: 1:5,500 at A3
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Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N
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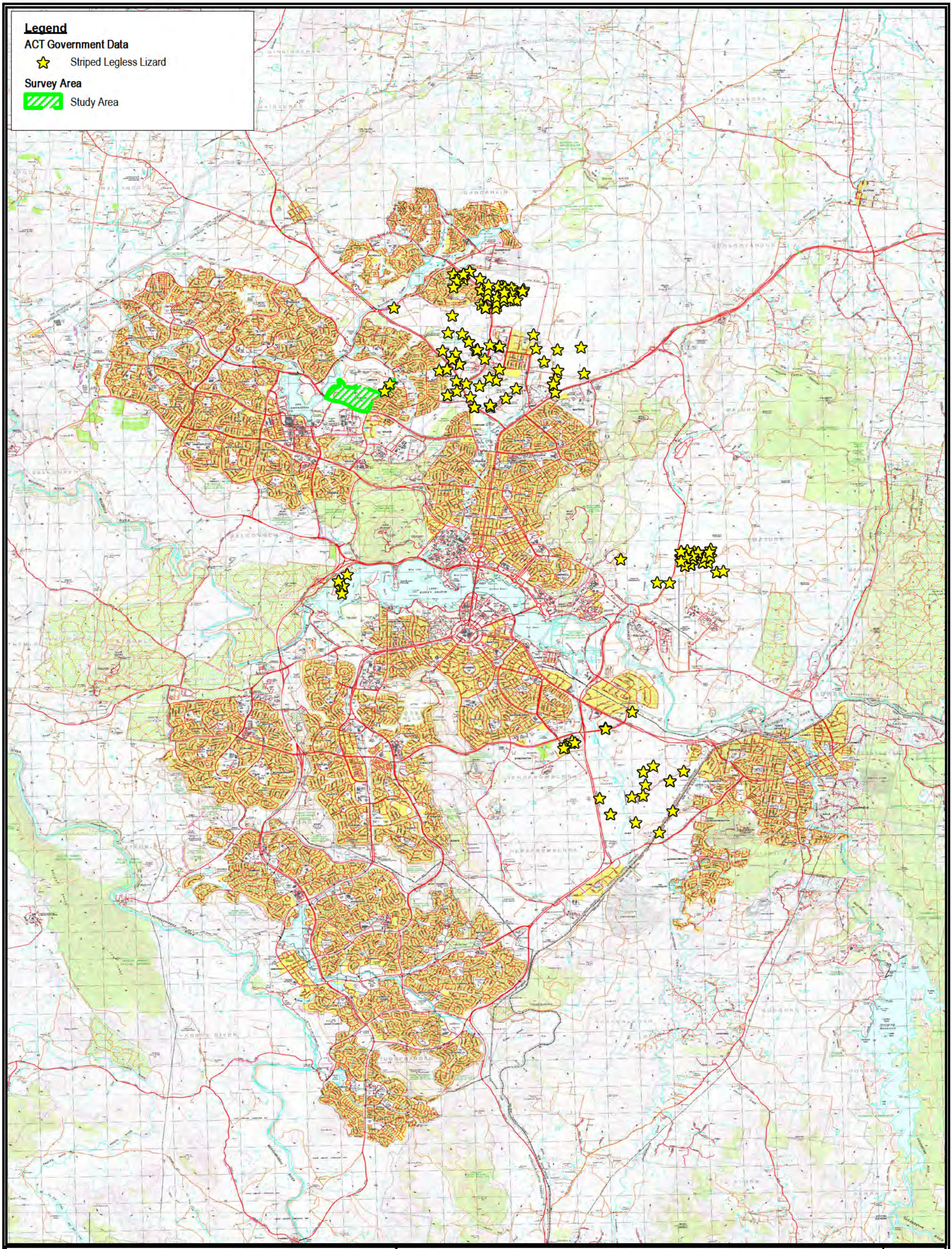
Figure 2



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Acknowledgements:
ACT Government
Topographic Image from Land and Property Management Authority
1:25000 topographic map series (2006)

Figure 3: Previous records of Striped Legless Lizard within the ACT - Lawson South.

Date: 1 March 2011	Drawn by: ANP
File number: 12338	Checked by: RS

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12338 F3_Lawson Sth ACT Data.WOR

0 1 2 3 4 5
kilometres
Scale: 1:100,000 at A3
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Map Grid: Map Grid of Australia Zone 56

N
W E
S

Figure 3

Legend

Pitfall Trap Array

Artificial Shelter Grid

ACT Government Data

Striped Legless Lizard Previous Recording

Survey Area

Study Area

Extent of Potential Striped Legless Lizard Habitat

LAW-T1
LAW-P3
LAW-P5
LAW-P4
LAW-T2
LAW-P2
LAW-P6
LAW-T3
LAW-P1
LAW-P7
LAW-P8
LAW-T4
LAW-P10
LAW-P9

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Figure 4: Targeted surveys for Striped Legless Lizard - Lawson South.

Date: 1 March 2011	Drawn by: ANP/STF
File number: 12338	Checked by: RS
Location:-..P:\12300s\12338\Mapping\DRAFT Figures\Lawson South\12338 F4_Lawson Sth Surveys.WOR	

Acknowledgements:
This product incorporates Data which is copyright to the Commonwealth of Australia (c.2003-)

0 75 150 225 300 375
metres

Scale: 1:7,500 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

Figure 4

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Personal Communications

Ian Smales – Senior Consultant Zoologist (herptofauna expert), Biosis Research. Provision of ongoing advice throughout study.

Steve Sass – Principal Ecologist (herpetologist), EnviroKey. Provision of background regarding results gained during previously completed studies.

Dr Murray Evans – Senior Ecologist, Conservation, Planning and Research, ACT Government Department of Territory and Municipal Services. Provision of advice and background during study.

Greg Baines – Senior Ecologist, Conservation, Planning and Research, ACT Government Department of Territory and Municipal Services. Provision of advice and background during study.

Adam Nugent – Estate Management Officer, ACT Government Land Development Agency. Provision of information regarding bushfire management actions and other property management.

APPENDICES

Survey Guidelines for Striped Legless Lizard

Conservation Planning and Research
September 2010

Purpose

These guidelines aim to promote a consistent and reliable method for determining the presence of Striped Legless Lizards at sites in the ACT. These methods are generally less suitable for determining abundance or distribution across a site (which usually requires greater survey effort). These guidelines are broadly consistent with survey guidelines for the species under the *Environment Protection and Biodiversity Conservation Act 1999*.

Habitat

Striped Legless Lizards in the ACT occur in Natural Temperate Grasslands and secondary grasslands (derived from cleared grassy woodlands). Preferred sites are relatively undisturbed and dominated by dense perennial tussocks (mostly Themeda, Danthonia, Stipa and Poa). The species has also been observed to occur in heavily disturbed areas dominated by exotics (such as Phalaris) that are within 2 km of high quality native grassland sites. Poor habitat characterised by high levels of disturbance from ploughing and fertilizer, and a high proportion of bare ground.

Survey Methods

Survey should be conducted in areas that appear to be the most suitable habitat for the species at a site. Surveys are best done in vegetated areas, not areas of open bare ground. Surveys can be undertaken using pitfall trapping or artificial shelters. Pitfall traps have the advantage that surveys can be completed within a shorter period, whereas artificial shelters have the advantage that they are generally less damaging to the site and are not traps and so do not have to be checked (inspected) frequently (or at all). Because there is insufficient data available to allow trap rates to be directly compared between the two methods, the same method should be used for all sites during the survey program.

Pitfall Trapping

- Survey timing: October to December.
- Pitfall trap buckets should be at least 20 cm diameter and 20 cm deep, with small drainage holes in or near the bottom. Buckets are placed in the ground flush with, or slightly below, the ground surface.
- Substrate (such as leaf litter, rocks, wood debris) should be placed in the bottom of each bucket, including a length (about 10 cm) of PVC tube (about 4 cm diameter) (or similar natural substrate) for animals to shelter and hide in, and a block (about 6 cm high) of moistened sponge to provide humidity and to act as a platform for animals to climb onto in the event of flooding.

- Each pitfall should have at least 5 m of drift fence passing vertically over the centre of the bucket, ensuring that the bottom of the fence does not curl to form a lip upon which the lizards can traverse the pitfall. The drift fence should be about 30 cm high and be trenched at least 2 cm into the ground to act as an anchor and to prevent Striped Legless Lizards passing under the fence. The drift fence should be made of a material that prevents the lizards climbing over the fence (smooth plastic sheeting such as 'Polyscrim' or woven shadecloth).
- Pitfalls can be set out individually or arranged into multi-pitfall arrays. Pitfalls set out individually should each be placed at the centre of a 5m length of drift fence. Pitfalls in arrays are linked by drift fence, with 5 m spacing between pitfalls along the drift fence. Arrays can be a single straight line or two straight lines forming a 'cross'. Each array can have up to 5 pitfalls, with each pitfall having 5 m of drift fence. The drift fence should extend at least 2.5 m beyond the pitfalls at the ends of the array.
- Minimum numbers of pitfalls per site area are:
  - sites less than 25 ha: 2 pitfalls for each hectare, minimum of 10 pitfalls.
  - sites greater than 25 ha: minimum of 50 pitfalls.
- Each pitfall must be checked daily, for a total of 28 days.
- Care should be taken to ensure stock will not be injured by the pitfalls, which may require stock to be removed from the site or pitfall locations to be temporarily fenced to exclude stock.
- Pitfalls must be removed at the finish of the survey and the holes filled in. If the survey is to be continued in the following year, pitfalls should be closed until they are used again. This usually involves filling the buckets with wood chips or other material that will render the buckets safe for people or stock until they are reopened or removed.

Artificial Shelters

- Survey timing: September to December, plus placement of tiles at least one month prior to survey.
- Artificial shelters are roof tiles, timber blocks, or other similar structures that are placed on the surface of the ground to provide shelter and thermoregulatory sites for Striped Legless Lizards. Paving bricks have been found to be less effective because they 'bed down' too firmly in to the substrate. Striped Legless Lizards can be detected under shelter sites from sightings of individuals or presence of sloughed skins.
- Artificial shelters should be placed on the ground in grids, with each grid containing 50 shelters in a configuration of 10 x 5 shelters, at 5 m spacing.
- Numbers of artificial shelter grids per site area are:
  - sites less than 30 ha: 1 grid per 3 ha, minimum of 2 grids.
  - sites greater than 30 ha: minimum of 10 grids.
- Artificial shelters should be placed on the ground at least 4 weeks prior to the first check.
- The frequency of checking of artificial shelter sites is flexible, and may range from twice per week to once every 2 weeks. However, once a checking frequency is chosen, that frequency should be maintained for the entire survey period to provide consistency and facilitate interpretation of results.
- Each artificial shelter should be checked for a total of 20 checks that span a minimum of 3 months.
- Artificial shelters must be removed at the end of the survey period. Artificial shelters may remain on the ground if they will be used in the following year. All broken shelters should be replaced or removed.

Appendix B. Weather observations for survey periods

Table 3. Weather observations during pitfall trapping monitoring period

Daily Weather Observations for Canberra, Australian Capital Territory Copyright 2003 Commonwealth Bureau of Meteorology				
Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)	Sunshine (hours)
*27/11/2010	10.1	27.5	0	8.3
*28/11/2010	15.9	18.9	6	1.4
*29/11/2010	11.4	16.4	36.6	0.3
30/11/2010	11.2	17.5	14.6	0
1/12/2010	14.1	19.2	10.8	0.4
2/12/2010	14.8	24.9	9.8	4.4
3/12/2010	13.4	22.4	87	3.1
4/12/2010	15.6	26.1	1.6	5.5
5/12/2010	12.2	26.6	29.6	11
6/12/2010	13.7	24.5	0	6.6
*7/12/2010	15.5	27.1	0	10.8
*8/12/2010	16.2	28.4	0	7.4
9/12/2010	18.3	26.2	32	3.8
10/12/2010	14.2	24.1	7	11
11/12/2010	9.7	22.1	0.2	12.9
12/12/2010	13.3	22.9	0	13.6
13/12/2010	6.6	24.5	0	11.7
*14/12/2010	12.6	25.2	0	7.4
*15/12/2010	12.2	28.3	0	10.8
*16/12/2010	12.9	25.7	7.2	10.4
*17/12/2010	10.9	23.6	0	8.2
*18/12/2010	13.9	19.4	0	8.8
*19/12/2010	4.7	21.8	5.4	5.2
*20/12/2010	6.8	17.7	7.4	8.3
*21/12/2010	9	19.9	0	13
*22/12/2010	5.5	24.9	0	12.4
*23/12/2010	9.1	28.1	0	12
*24/12/2010	13.6	21.7	0	7.1
25/12/2010	8.6	29.1	0	7.7
26/12/2010	13.3	28.2	0.4	8.5
*27/12/2010	14.5	25.5	0	8.4
*28/12/2010	7.3	21.8	0	11.7
*29/12/2010	7.8	28.7	0	12.2
*30/12/2010	11	31.5	0	13.4
*31/12/2010	12.4	33.9	0	11.6
*1/01/2011	14.6	34.4	0	12.5
*2/01/2011	17.9	30.9	5.2	7.6
*3/01/2011	15.3	20.1	0	4.7
*4/01/2011	13.5	21.3	0	4.1
*5/01/2011	10.2	28.5	0	7.5
*6/01/2011	10.3	24.1	11	9
*7/01/2011	11	25.4	0	9
*8/01/2011	16.5	28.9	0	9.1
	Maximums and Totals			
Highest	**18.3**	**33.9**	**87**	**13.6**
Lowest	**4.7**	**17.5**	**0**	**0**
Average	**12.31**	**24.83**	**6.47**	**8.20**
Total			**287**	

* Indicates pitfall trap monitoring day

Table 4. Weather observations during artificial shelter monitoring period

Daily Weather Observations for Canberra, Australian Capital Territory Copyright 2003 Commonwealth Bureau of Meteorology				
Date	**Minimum temperature (°C)**	**Maximum temperature (°C)**	**Rainfall (mm)**	**Sunshine (hours)**
*8/01/2011	16.5	28.9	0	9.1
9/01/2011	14.7	22.8	0	1.8
10/01/2011	17.8	26.5	15.2	5.8
11/01/2011	17.1	22.3	0.6	0.2
12/01/2011	18.9	25.7	2.6	1.4
13/01/2011	20	24.2	9.8	0.5
*14/01/2011	17.4	26.1	3.8	1
15/01/2011	19.7	31	0.2	10
16/01/2011	15.2	32.3	0	11.5
17/01/2011	16.1	30.4	0	13.2
18/01/2011	12.9	26.5	0	11.5
19/01/2011	15.1	27.5	0	8.9
20/01/2011	13.1	28.2	0	7.5
*21/01/2011	12.4	30.5	0	11.3
22/01/2011	16	31.2	0	10.9
23/01/2011	13.6	30.2	5.6	11
24/01/2011	15.8	30.6	0	8.3
25/01/2011	16.6	31.5	0	
26/01/2011	15.7	36.9	0	
*27/01/2011	18.9	34	0	
		Maximums and Totals		
Highest	**20**	**36.9**	**15.2**	**13.2**
Lowest	**12.4**	**22.3**	**0**	**0.2**
Average	**16.18**	**28.87**	**1.89**	**7.29**
Total			**37.8**	

* Indicates artificial shelter monitoring day

Appendix C. Records of all vertebrates and notable invertebrates recorded during surveys

Table 5. Vertebrate fauna captured in pitfall traps

Species Name	Common Name	Date	Pitfall Array Name	Notes
Crinia signifera	Common Eastern Froglet	7-12-2010	LAW-P3	
Crinia signifera	Common Eastern Froglet	14-12-2010	LAW-P1	
Lampropholis delicata	Delicate Skink	15-12-2010	LAW-P1	
Lampropholis delicata	Delicate Skink	15-12-2010	LAW-P7	
Limnodynastes tasmaniensis	Spotted Grass Frog	15-12-2010	LAW-P10	
Lampropholis delicata	Delicate Skink	15-12-2010	LAW-P10	
Neobatrachus sudelli	Spotted Burrowing Frog	16-12-2010	LAW-P2	
Crinia signifera	Common Eastern Froglet	16-12-2010	LAW-P9	
Neobatrachus sudelli	Spotted Burrowing Frog	17-12-2010	LAW-P1	
Neobatrachus sudelli	Spotted Burrowing Frog	17-12-2010	LAW-P2	
Neobatrachus sudelli	Spotted Burrowing Frog	20-12-2010	LAW-P1	3 individuals.
Crinia signifera	Common Eastern Froglet	20-12-2010	LAW-P6	2 individuals.
Neobatrachus sudelli	Spotted Burrowing Frog	22-12-2010	LAW-P1	
Neobatrachus sudelli	Spotted Burrowing Frog	23-12-2010	LAW-P1	
Lampropholis delicata	Delicate Skink	24-12-2010	LAW-P2	
Lampropholis delicata	Delicate Skink	24-12-2010	LAW-P10	
Lampropholis delicata	Delicate Skink	27-12-2010	LAW-P1	
Neobatrachus sudelli	Spotted Burrowing Frog	30-12-2010	LAW-P9	
Lampropholis delicata	Delicate Skink	31-12-2010	LAW-P3	Gravid female.
Limnodynastes tasmaniensis	Spotted Grass Frog	31-12-2010	LAW-P6	2 individuals.
Crinia signifera	Common Eastern Froglet	2-01-2011	LAW-P6	
Crinia signifera	Common Eastern Froglet	5-01-2011	LAW-P10	
Neobatrachus sudelli	Spotted Burrowing Frog	6-01-2011	LAW-P10	
Neobatrachus sudelli	Spotted Burrowing Frog	7-01-2011	LAW-P9	
Neobatrachus sudelli	Spotted Burrowing Frog	7-01-2011	LAW-P10	
Limnodynastes tasmaniensis	Spotted Grass Frog	8-01-2011	LAW-P7	
Crinia signifera	Common Eastern Froglet	8-01-2011	LAW-P9	2 individuals.

Table 6. Notable invertebrate fauna captured in pitfall traps

Species Name	Common Name	Date	Pitfall Array Name	Notes
Synemon plana	Golden Sun Moth	7-12-2010	LAW-P5	Female.
Synemon plana	Golden Sun Moth	16-12-2010	LAW-P5	Male.
Coorabarama canberrae	Canberra Raspy Cricket	23-12-2010	LAW-P2	2 individuals.
Synemon plana	Golden Sun Moth	29-12-2010	LAW-P4	1 Male, 1 Female.
Coorabarama canberrae	Canberra Raspy Cricket	1-1-2011	LAW-P2	
Coorabarama canberrae	Canberra Raspy Cricket	7-1-2011	LAW-P7	

Table 7. Vertebrate fauna recorded under artificial shelters

Species Name	Common Name	Date	Tile Grid Name	Notes
Delma inornata	Olive Legless Lizard	8-01-2011	LAW-T3	Snout-vent length = 110mm Total length = 320mm
Delma inornata	Olive Legless Lizard	8-01-2011	LAW-T4	Snout-vent length = 120mm Total length = 340mm
Delma inornata	Olive Legless Lizard	8-01-2011	LAW-T4	Snout-vent length = 125mm Total length = 350mm
Lampropholis delicata	Delicate Skink	14-01-2011	LAW-T2	
Delma inornata	Olive Legless Lizard	21-01-2011	LAW-T2	Snout-vent length = 115mm Total length = 340mm Slough (shed skin) also found
Delma inornata	Olive Legless Lizard	27-01-2011	LAW-T3	Snout-vent length = 115mm Total length = 330mm

Representative photographs of recorded fauna

Olive Legless Lizard (*Delma inornata*) recorded at LAW-T3 (R. Speirs - Biosis Research 2011).

Olive Legless Lizard (*Delma inornata*) recorded at LAW-T2 (R. Speirs - Biosis Research 2011).

Delicate Skink (*Lampropholis delicata*) captured at LAW-P2 (S. Vertucci - Biosis Research 2010).

Canberra Raspy Cricket (*Coorabarama canberrae*) captured at LAW-P2 (R. Speirs - Biosis Research 2010).

Golden Sun Moth (*Synemon plana*) captured at LAW-P5 (R. Speirs - Biosis Research 2010).